Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock

INDEX FOR VOLUME XI, 1898.

Illustrated articles are marked with an asterisk (*).

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LOCOMOTIVE ENGINEERING
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Building a Locomotive.

As a fitting celebration of our tenth birthday we know of no better way of interesting our army of readers than by illustrating the building of their favorite machine, the locomotive. With this end in view we have been to quite an expense in the way of illustrations, but as we have never been satisfied with anything but the best, this will be no surprise to them.

It would be impossible to attempt detail description of the various processes connected with locomotive building, even if it were desirable, but instead, the different branches of the work will be briefly mentioned and the pictures left to tell the bulk of the story, which they will do with very little outside assistance.

The illustrations have been secured through the kindness of both the Baldwin and the Pittsburg Locomotive Works, the others applied to not having the desired views of their works suitable for illustrating this article, and not having time in which to have them prepared.

BLUE PRINT ROOM—BALDWIN'S.

MAIN DRAWING ROOM—BALDWIN'S.

THE DRAWING ROOM.

As all machine work in these days of modern systematic construction is planned and started in the drawing room, the first views show two departments of the Baldwin drawing room, the main room and the blueprint department in the room above.

It is in the drawing room where all the ideas of various railroad men are put into shape for trial. Here, not in the Baldwin works however, the wild and wonderful ideas of the Holman and Gilderfluke locomotive were transferred to paper, to be forever perpetuated for the coming generations, and here also the really useful ideas find their way into practical shape.

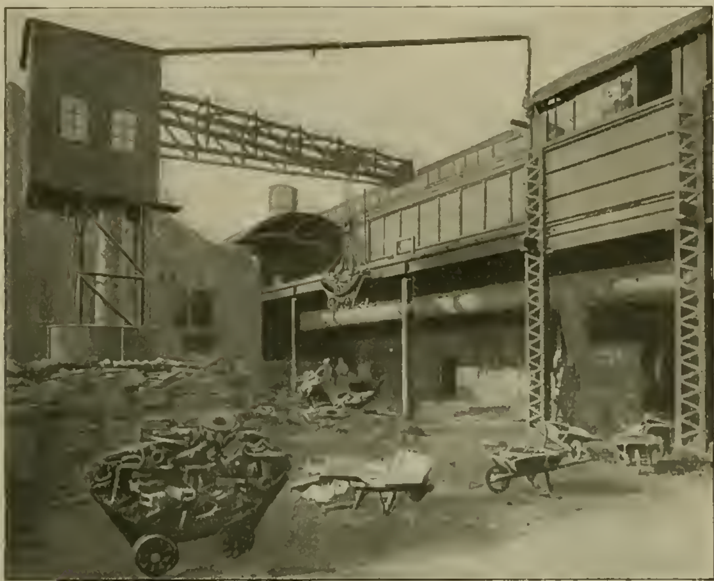
Here the engine is planned and drawn, the tracings made (usually on tracing cloth), from which blueprints are made to be sent into the shop for the men to work by, and as blueprints are now so common, it may be interesting to know how they are made.

Drawing paper is coated with a solution which is sensitive to light, and which must, of course, be kept in the dark. The tracing is laid over a sheet of the prepared paper and both put into a frame with a glass front, which holds them together, and are then exposed to the light by being run out of the window on the small track shown.

Wherever the sun shines through the tracing cloth it turns the paper blue, but as the inked lines of the tracing prevent the passage of light, the paper under them remains white. The paper is then washed in clear water, and after drying is ready to be mounted on cardboard for shop use. This makes a very cheap way of reproducing drawings and is being universally used.

After the drawings and blueprints are made the pattern maker is put to work getting out the required patterns for the castings which differ from those in the regular engines. There is very little machinery used in the pattern room, which is not familiar to nearly every one, and as no good photograph was obtainable this had to be omitted.

While the pattern maker is at work it may be well to visit the laboratory, where the material used in construction is tested, both chemically and physically. In other words the metal is tested to find exactly what it is composed of, and then to see what strength it has and what strains it will stand, for modern locomotive building is conducted on a scientific basis, and all material must be of the required strength and composition or it is not accepted. The two views show the chemical room and testing room, respectively.



PIG IRON AND SCRAP READY FOR FOUNDRY—BALDWIN'S.

THE FOUNDRY.

The foundry comes next, and here the patterns are molded in the sand and the metal poured into the molds, all cast iron parts such as cylinders, wheel centers and similar parts being made here. An idea of the immense amount of iron used in a large foundry can be had by noting the piles of pig-iron in the foundry yard, and the huge crane for handling it.

The views in the foundry, taken from both the works mentioned, give a good general idea of the work done and need not be mentioned in detail.

By this time all the departments are hard at work finishing the parts they are to furnish, the drawings being ready for them and furnishing their guide without waiting to make their work fit that of the other department. This kind of machine work has no place in modern machine shops of any kind, and it is the system of duplicate parts which has made possible the lower prices for the locomotives and the turning out of such a large number from one shop.

THE HAMMER SHOP.

Taking the hammer or forge shop, we get an idea of the work they do, the fires used and the hammers, large and small, which forcibly coax the metal into the desired shape at the bidding of the hammerman. The row of drop hammers is from Baldwin's, and is used for light forgings; while the large steam hammers shown forge the largest portions, frames and the like, into their proper shape. That these are large can be seen from the comparative size of the men, and they can strike a blow that resembles a young earthquake. Although they are so large and apparently unwieldy, the hammermen acquire great expertness in handling them, and the story is told of an inquisitive visitor, who had heard of the wonderful precision with which they could be handled—that they could crack a walnut as neatly as with a small hammer, and other similar stories. He wandered into the hammershop one day and began to bother the hammerman with questions, to know if he could do these things, could crack a walnut, drive a tack, etc. Certainly he could, and probably could have cracked the inquisitor's head with a relish. Then a brilliant scheme overpowered the man. Couldn't he do the same with a watch—crack the crystal as he did the walnut? "Sure," said the hammerman, and the experimenter boldly placed *his wife's watch* on the anvil, and began to make up some of the stories he would tell about the wonderful feat, and how proud his wife would be to think he had taken her watch, instead of his own, for the experiment, when "Bang!" the hammer dropped as though it was putting the last touches on a frame for a mogul.

When the man had recovered sufficiently to talk, he blurted out, "But you said you could break the crystal," and he slowly gathered up the remains and dreamt of the lecture at home. "Well, didn't I? If you find a piece of that crystal that isn't broken, I'll give you the hammer," said the hammerman, glad to be rid of one nuisance.

Nevertheless, they do become very expert, and handle the hammer so as to give the kind of blow required for the work in hand.

The forging of rods and other plain work is not very difficult; but on the frames, with their numerous jaws for driving boxes in the many wheeled engines used for freight service, the work is much more difficult, as considerable welding has to be done, and this requires care and skill, as much depends on its being thoroughly done.

CHEMICAL LABORATORY—BALDWIN'S.

Quite a variety of forge-shop work is shown, giving an idea of the treatment of different pieces.

THE BOILER SHOP.

While the castings and forgings are being made, the boiler shop is also at work, so as to bring the different parts of the work along at the same time, to be ready for the erecting shop together.

The sheets have to be laid out, to be rolled into shape, if they are the plain or round sheets of the boiler, to be punched and the holes reamed for riveting, and then taken to the riveting machine to be riveted. Such pieces as the boiler head, dome flange, tube sheets, etc., are now formed in a hydraulic press by placing the heated sheets between the proper shaped dies and pressing them to shape; the forming of sheets by using a sledge over a cast-iron block being an out-of-date method which is neither economical nor desirable, as it must injure the sheets much more than the forming press, which is now a part of every well-equipped boiler shop. Although the first cost of the necessary dies is considerable, they are cheaper in the end, and produce far better work.

In a like manner, hand riveting has given way to machine riveting in most boiler work, although there are a number of points where hand work is necessary on account of the work not being get-at-able with a riveting machine. The firebox is an example of this. With machine riveting, the sheets are pressed together, and the rivet headed over by a steady pressure all over it, which strains the metal in the rivets less than the many blows of the hammer in hand work. Riveting machines are usually operated by hydraulics, although in some places a combination of compressed air and hydraulics is being tried.

Besides riveting, the setting of flues comes within the work of the boiler shop, and this is also an interesting and important part of the work, as is staybolts and the proper staying of the firebox. But as our friend Jim Skeevers has given us many good object lessons on those points, we will leave the boiler shop, with all its noise, and see what is being done on the machine work.

READY TO POUR—PITTSBURGH.

THE MACHINE SHOP.

There are so many departments in the machine work of locomotive building that only a few of them can be shown, the work being now divided so that one room or section of a room makes but one piece, and we find the crossheads made here, the piston rods turned up there, while all the side and main rods are made in still another department, and so on through the long list of parts which go to make up the interesting whole.

TESTING LABORATORY—BALDWIN'S.

These parts are all made in quantities as far as possible, crank pins, piston rods, etc., being kept in stock for engines of usual sizes, and when assembled together, they fit, as being made to gage. The day of individual fitting of the parts of an engine has gone by. This is the reason that the Baldwin Works can turn out 1,000 complete locomotives in a year, or over nineteen per week, and the other works in proportion, depending on the size of their plants.

In the machine shop we see the frames being planed, and at the left of the planer a frame is being drilled for the various bolts which go through it. Rods are also being machined, either by planing or milling, or both, and in the case of solid end side rods the ends are bored very carefully to receive the brasses, as it is necessary to have them of the exact length to prevent trouble from heating when in use. The machinery in use to-day makes this a comparatively easy matter, although, of course, care and skill are at all times necessary.

The general view of the machine shop is from the Pittsburg works, and shows the arrangement of their main shop, with the heavier tools on the ground floor and the lighter ones on the gallery on each side. As will be seen, there is ample provision for handling work by cranes, and it should be noticed how light this shop seems, especially for one in Pittsburg, with its smoke and soot. Not only are the walls painted white, but the tools are also of the same color, and, while it is quite a shock to the nervous system of some shop men who think white tools are entirely out of place, it adds materially to the light in the shop, and that should be the main consideration.

Driving wheel lathes are shown at work, but not on driving wheels, they are boring out driving boxes instead, and it

IN THE FOUNDRY—BALDWIN'S.

ONE OF THE BIG HAMMERS—PITTSBURGH.

will also be noticed that they are electrically driven, a very convenient feature when you wish to run one or a few machines without running the whole shop.

The other views show the crosshead department and cylinder boring section, each giving an idea how the work is handled.

BLACKSMITH SHOP AND SMALL FORGES—BALDWIN'S.

The cab shop is not very different from other wood working shops, except for certain features which are necessary for the making of this particular work, but as the American cab is such a distinguishing feature in locomotive work and has been the means of causing better protection for enginemen to be adopted elsewhere, it is at least worth a moment's consideration.

THE ERECTING SHOP.

This is the final department, so far as the mechanical work is concerned, for it only leaves the artist and his brush to complete the engine, and, providing he doesn't get stalled in painting some Russian or Chinese name on the cab, this operation doesn't take very long as a general thing.

The erecting shop is the final test of each department, and tells in an unmistakable way whether the work has been done correctly or not. If it hasn't, and parts do not fit, there is trouble for some body, and the right somebody isn't hard to find in most cases.

The two views show in a general way the method of erecting. The frames are placed in position and the work of erecting commences, the cylinders being bolted on as a commencement of operations. Then the various parts are added piece by piece, the boiler brought in from the boiler shop and placed in position, and the parts begin to assume a definite shape as they gradually grow into that interesting and rather intricate machine which has grown to be such an important factor in our every-day life, as well as playing such a part in every branch of modern civilization—the locomotive.

FORGING AND BENDING PRESS—BALDWIN'S.

The Grand Trunk Railway Literary and Scientific Institute.

In 1857 there was founded, in Montreal, the nucleus of what has since grown to be in all probability the largest and best library, having connection with a railroad, on this continent. The intent of the projectors, the officials of the Grand Trunk, was to give the employés a solid mental pabulum, at that time not elsewhere easily within their reach, and the number and quality of the volumes on the shelves to-day attest eloquently to the stewardship of the trust handed over to their keeping at that time.

The institute received its first incentive to become an organization by the late president, Sir Joseph Hickson, and from its small beginning it has reached its present high plane by the encouragement of succeeding officials, as well as by internal management of the best order. Many well-known names are seen on the roster, of those who were early identified with the well-being of the institute, among which is F. H. Trevithick, the first locomotive superintendent (the date opposite his name is 1857, the year of its birth), and Mr. T. E. Blackwell, locomotive superintendent, 1858; also C. J. Brydges and many others in railway management.

There are at this time about 7,000 volumes on the shelves, comprising literature from the pens of the choicest writers, ancient and modern, in the field of fiction. Technical works in every branch of science are here, also for circulation, besides immense volumes used for reference only, and never taken from the rooms, following in this respect the larger libraries. These books are for the use of the employés and their families only. All the best papers and periodicals, foreign and domestic, are on file. The method taken to avoid an accumulation of periodicals, and still preserve them to the members, appears to have some good points. LOCOMOTIVE ENGINEERING, in evidence here, and some others are put up at auction to the highest bidder after they are three months old, and they invariably net a good round sum from somebody, particularly if there are two or more who happen to want them.

The building in which the institute now has a permanent home was erected by the Grand Trunk Railway at the shops. It is a substantial brick structure, and has, in addition to the library and reading room, a fine auditorium fitted with a stage and scenery, which are put to good use by the amateur theatrical association made up of employés, during the winter months. Much interest is taken in this player contingent, and every indication of histrionic talent is fostered, with the result that the company contains many artists of decided merit. They are said to be able to put on and play anything from the "Lady of Lyons" to the "Colleen Bawn," at a minute's notice. How different this case from that of the writer, who, when learning the machinist's trade, was informed by an unsympathetic foreman that he must choose between private theatricals and the shop, thus nipping i' the bud a promising stage career, and perchance putting opulence forever beyond our reach!

LIGHT HAMMERS FOR DROP FORGING—BALDWIN'S.

BOILER HEADS, DOMES, ETC.—PITTSBURGH.

One of the features most highly prized in connection with the institute, is the system of baths, the use of which is a part of the benefits accruing to membership. The privileges of the bath, reading room and library are secured to the members by a contribution of ten cents a month; the fund thus created going to the purchase of books and covering expenses incident to the management of a large venture of this kind. A drawing school for the education of the apprentice is also pushed here, and an interest in it is kept up by the advancement of all who show, by proficiency, that the seed so carefully sown has fallen in fertile places. The officers governing the institute comprise the president, General Manager Hays, two vice-presidents, Assistant Mechanical Superintendents McWood and Wanklyn and a board of trustees. That the institute is a success is shown by a membership of about 700 at this time, and that it has not been mismanaged, a continuous success of forty years carries indubitable proof.

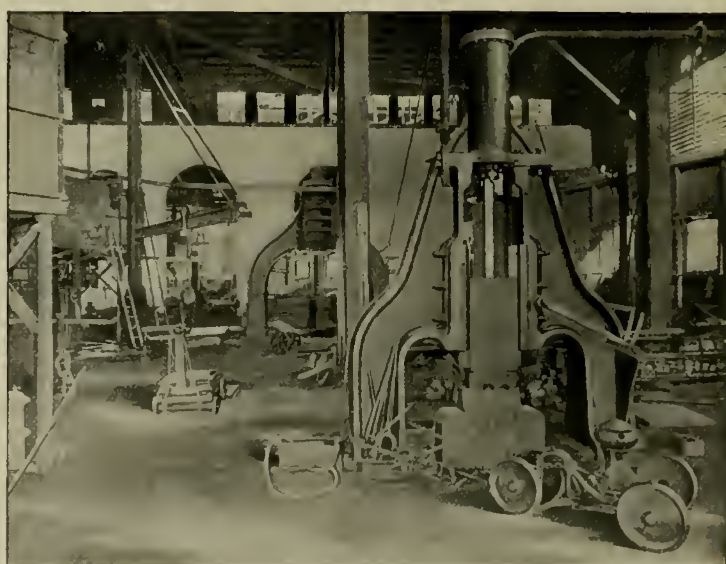
Railroading with the Confederacy.

BY CARTER S. ANDERSON.

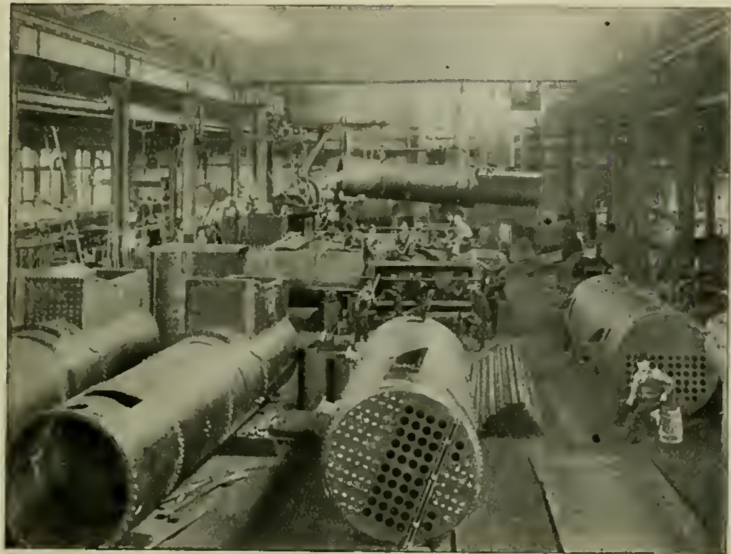
December 1, 1897.

My last letter closed with a promise to write more about what happened during the Kilpatrick-Dahlgren raid, in Virginia, February 29, 1864.

As I stated, in substance, in my last letter, this raid opened the military movements of that most eventful year in which our soldiers met and settled forever, we hope, upon the field of battle, what statesmen, trammelled by the technicalities of legislative enactments, had failed to satisfactorily adjust. We realized by practical experience, what we had hitherto regarded as sentiment, that "united we stand, divided we fall."



A CORNER IN THE HAMMER SHOP—BALDWIN'S.



THE BOILER SHOP—PITTSBURGH.

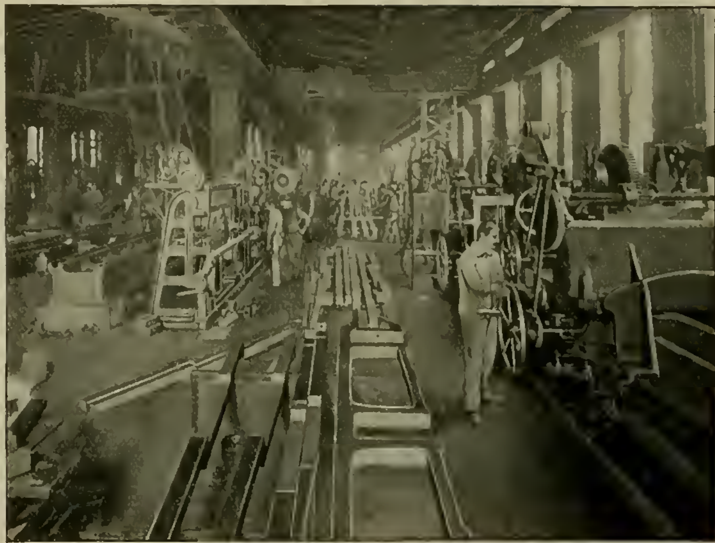
In my last letter we had reached Hanover Court House. It was the morning of March 1, 1864. The momentous question was, "Where is Gen. Kilpatrick?" He had crossed the Virginia Central Railroad at Beaver Dam the evening before, headed for Richmond. Consequently, he was expected everywhere and by everybody in Goochland, Hanover and Henrico counties. How to entertain the expected guest, was a question which gave his anxiously awaiting hostesses great concern. The farms, full of life at other times, would appear deserted when a raid was anticipated. Cattle were hid in the bushes, and bacon and other valuables were stuck away in every conceivable place. My young wife, during a certain raid, put $40 in gold under a setting hen! Men would be either bushwhacking or hid in the houses, and sometimes the oldest woman in the family would answer the call at door or window. It was a saying down here that "a dog never barks at a Yankee cavalryman." Whether the rattling sabre makes the ravenous cur slink away, or whether it was a Yankee trick, we never knew; but the fact remained. Such a state of things existed at Hanover Court House the morning of which I write.

FINISHING CROSSHEADS—BALDWIN'S.

The old Hanover Court House tavern was kept by Mr. and Mrs. Clivis Chisholm. Two more original, odd and funny pair rarely marry. Mr. Chisholm was a very small and nervous man; while Mrs. Chisholm was a large, good-natured lady, and had a plenty of good common-sense besides. This old tavern was, during the latter part of the war, filled with refugees from those parts of the Eastern shore which were then held by the Union armies. Mrs. Chisholm really ran the hotel; "Clivis," as she called him, being willing to leave it all to the "old woman." In politics, Mr. Chisholm, like his distinguished neighbor, Gen. Wms. C. Wickham, and many other of our best citizens, was a Union man and opposed to secession. In fact, Virginia herself was opposed to it, and it is, of course, recognized as a historical fact that, could Virginia have remained neutral, she would never have seceded. Earnest, thoughtful and long were the sessions of our Virginia Convention during the winter of 1860-1861. Virginia does nothing rashly. Every important step she has ever taken has been the result of careful deliberation. Thus was she considering the very important matter of secession, when there came Mr. Lincoln's call for 300,000 troops! Then the die was cast, and our many men of many minds joined heart and hand to do battle *a la mort!*

THE ROD DEPARTMENT—BALDWIN'S.

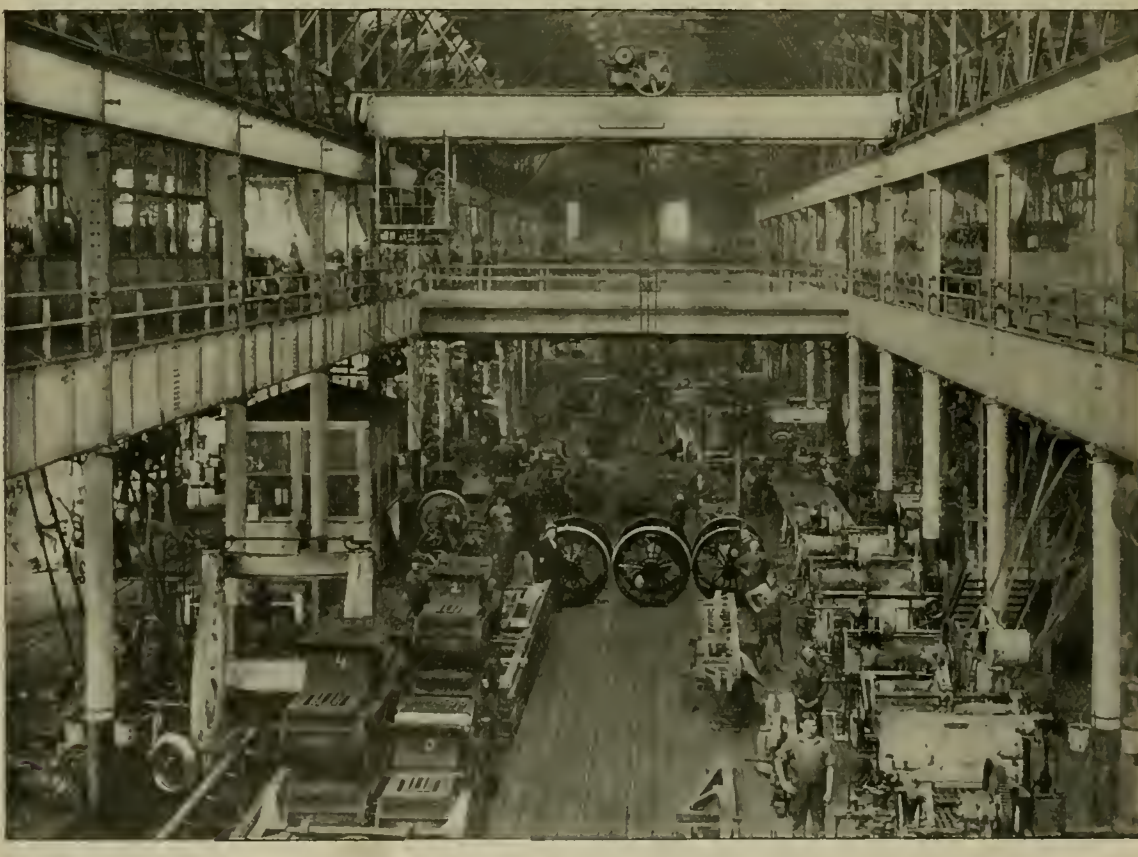
But to return to the old Hanover Court House tavern. Mrs. Chisholm, not knowing which army might come first, and realizing that Mr. Chisholm, in his excitement might make some impolitic and harmful statement, decided to put him away in some safe place. Nobody quite knows even now where that place was; but some assert positively that he was hidden between two feather beds. Then assuring him that she would meet and answer the officers, she marched bravely to the front. It was about 10 o'clock in the morning. As she looked down the Hanover County-road lane, as far as eye could reach, the road was full of cavalry. She did not know whether *they* were Northern or Southern troops; but, recognizing the safety of neutrality, she snatched up the first white thing she saw. It proved to be her little grandson's night-shirt. This she fastened to a stick, and placed it conspicuously in front of the bar-room. "If they be Union, *we* are Union; if they be Southern, so are *we*," said the diplomat to herself, while her flag of truce waved—its arms—proudly in the breeze! Beneath this she proudly took her stand, and bravely awaited the cavalry troops, who approached nearer and nearer—a General-Commander and his staff in front. The lady boarders were all assembled behind Mrs. Chisholm. They were not so exposed as she, but, woman-like, must see and hear.



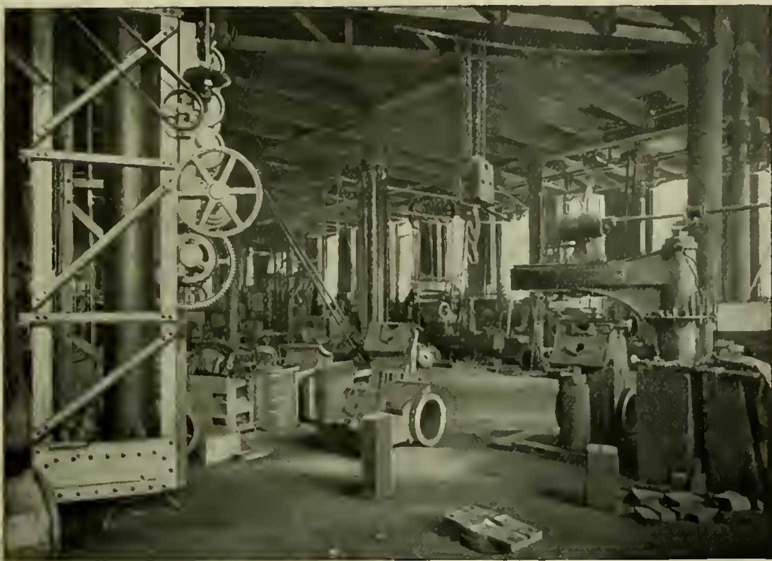
PLANING AND DRILLING FRAMES—BALDWIN'S.

"Good morning, madam," said the Commander, as he lifted his hat. "I am Gen. Hampton. I am looking for the Yankees. Where are all your men folk?"

"All that are any account are in the army, sir," promptly replied Mrs. Chisholm. "The others are all at the depot. There are none here." Being so much relieved at this turn of affairs, the hostess offered to prepare the General some refreshment. But he courteously declined. The ladies all surrounded Mrs. Chisholm



GENERAL VIEW OF MAIN SHOP—PITTSBURGH.



MACHINING CYLINDERS—BALDWIN'S.

door and down into the culverts under the railroad, and some hid in the ditches in the meadow near the store. I got into such a fit of ridiculous laughter at Mr. Briell and at the foolish way we all did, that I gave up all hope of escape, and sat down under the end of the counter, with my eye on the door, awaiting my fate. The door opened gently, and a soldier put his head in, saying again, "Hallo." I then got up. "We are citizens," said I, "and in our own house." The soldier opened the door and came in. "Gen. Hampton is out here," said he, "and wants to know about the roads from here to Richmond."

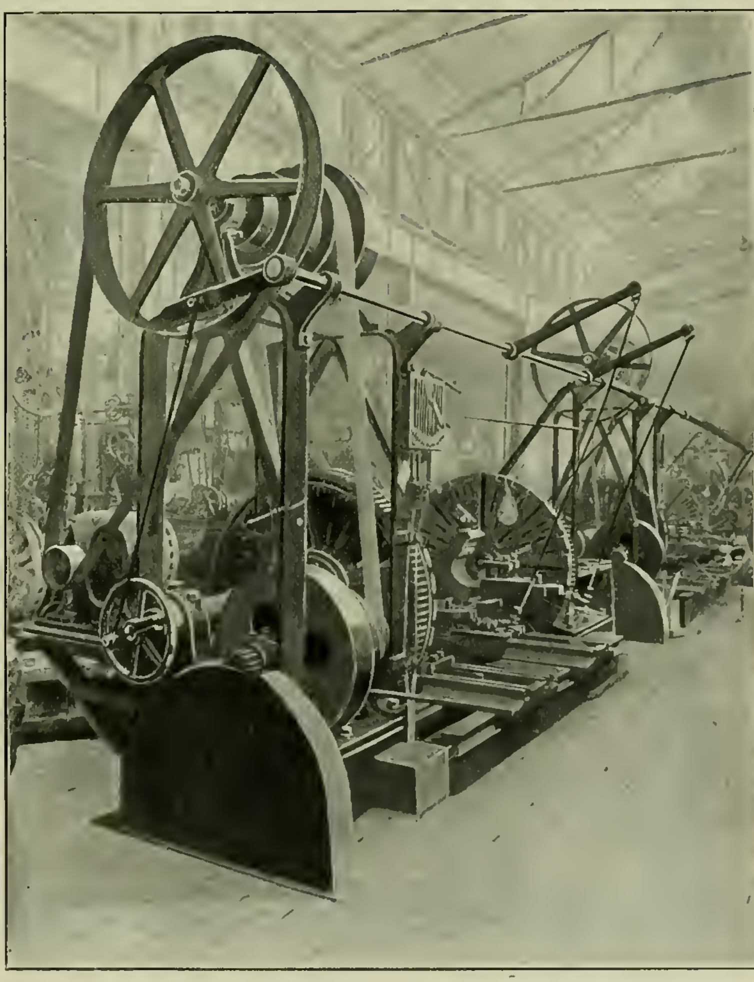
Before I could speak, Mr. Briell jumped up, and over the counter he went, running out to where the General sat on his horse. He soon, however, got so confused in trying to explain the roads to Gen. Hampton, that he stopped his explanations, and calling a youth who stood by, he said, "Willie, run down the hill yonder and call Andrew Wingfield. He can tell all about the roads better than I now, and looked with delighted eyes upon the noble General and his gallant troops.

"I must go on to the depot and find out about the roads, and then on to Richmond," said the General. He then took a good look at the old Court House, which was built in 1735, and which is still standing intact. He moved on. Huddled together around a stove in Barney Briell's little store at the depot were about a dozen of us.

For the past forty years one large proportion of the make-up of Hanover Court House has been Andrew J. Wingfield, from some unknown cause called "Colonel." This title was not from any military service. If he was ever brevetted on the field, it was for shooting birds. He was, and still is, a great hunter, and his prowess in that respect is undisputed. (He suffered, recently, a loss in the death of his dog, "Blackey." Shortly after the last election, some friend was regretting his defeat in the close run which he gave Dr. B. L. Winston, for the Legislature, and the Colonel replied: "Pshaw, I don't give a d—— for the Legislature, if I only had 'Blackey' back!") Well, the Colonel was one of us in the store that morning, and Mr. Robt. Doswell, County Clerk, and others. We were discussing matters military, and were every minute expecting to hear some war news.

"Hallo!" called a commanding voice in front of the store. Every eye was turned to the glass in the upper part of the door, through which we could clearly see that the front yard was full of cavalry troops.

"Kilpatrick's men," said somebody. Barney Briell, who had been sitting on the counter, with one motion fell quietly backwards and rolled out of sight under the counter. All the rest of the crowd, except myself, ran out through the back



DRIVING WHEEL LATHES—BALDWIN'S.

BUILDING CABS—BALDWIN'S.

store, about ten miles from Richmond, where the road from Atlee comes into the Richmond road, he learned that Kilpatrick had gone on toward Atlee. Consequently, Hampton turned in pursuit, going toward Atlee, and arriving there about midnight of March 1st. He and his staff stopped at Atlee station. It was a cold, snowy, sleety night. Gen. Hampton, hearing that reflected light had been seen in the woods below Atlee, sent Col. W. H. Cheek, Second North Carolina Regiment Cavalry, to see if it was the enemy, and if he found it was, to make the attack. The North Carolina Cavalry soon came upon the pickets, and exchanged shots. The Federal pickets retired, but must have failed to report, as Col. Cheek's men went within fifty yards of the fires. One hundred and fifty sharp-shooters of First North Carolina Regiment were in front, and were under command of Capt. Blair.

can. Willie, tell him it is Gen. Hampton and his men."

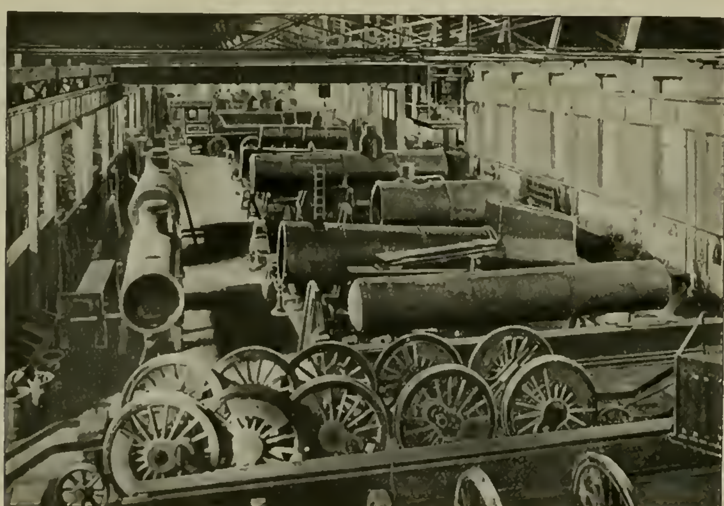
Willie went running down the hill, calling at the top of his voice: "Oh, Col. Wingfield, Col. Wingfield!"

The Colonel, who was in the railroad culvert, here put his head partly out, and said: "Hush, hush, you little red-headed devil! Don't call me 'Colonel' now. Call me anything—call me 'grand-pa!' "

"Well, grand-pa," said Willie, "Gen. Hampton wants you to tell him about the roads." In five minutes fully twenty men and boys rolled out of the culvert and ditches, and were soon surrounding Gen. Hampton, telling him all about the roads, and the spokesman was our Colonel—not "Grand-pa" Andrew Wingfield.

From Hanover Court House, Gen. Hampton went onward toward Richmond, *via* the roads which would have taken him on to the Brook Pike; but when he reached Booker Hazelgrove's

ERECTING SHOP—PITTSBURGH.



BOILERS AND DRIVERS IN ERECTING SHOP—BALDWIN'S.

They were ordered to lie down, and McGregor's battery opened fire. As soon as the first gun was fired, the sharp-shooters rose, yelled and charged the camp, surprising them and causing a stampede, and capturing 150 prisoners, many horses and equipments.

Dr. Thos. E. Williams, surgeon Second North Carolina Regiment, was ordered by Gen. Hampton to take charge of the Federal wounded. There were 150 prisoners, 200 horses, saddles, bridles, blankets, pocket-books, etc. Among the wounded prisoners, all of whom were well equipped, was an officer from Michigan. He made so much ado over his sufferings that Gen. Hampton told Dr. Williams he must go at once and attend to the man. The doctor thought from his cries of misery he must be mortally wounded. He begged the doctor to try to save his life. Dr. Williams began at once to examine his wounds. In the course of his examination, he found buckled around the man's waist a very fine money belt. Telling the officer he might as well give him this belt, the doctor proceeded to find the extent of his wounds, which were not serious, and so he told the man. This intelligence quieted the wounded soldier, but tightened the grip he had on his rich belt. A few days afterward, Dr. Williams had occasion to call at the Richmond Hospital to see his prisoner-patient, whom he had sent on to this hospital. The surgeon of the hospital quickly accosted Dr. Williams as he entered. "Tom Williams," said he, "I did not know you were such a fool!" "What do you mean?" asked Dr. Williams. "Why, the idea of any surgeon dressing the wounds of a prisoner who had on a belt with $2,000 in greenbacks, and not first relieve him of his belt!" Only the fact that the genial doctor expected to be married in a month prevented him from committing suicide. The doctor, to this day, grieves over the wrong treatment of that serious case.

But I must go back to the night of the battle. Confederate States Surgeon Thos. E. Williams, of the Second North Carolina Cavalry, to whom I am indebted for the details embraced in this part of my narrative, was ordered by Gen. Hampton to take all the wounded prisoners back to Booker Hazlegrove's store, which was on the main Richmond road, so that they could be cared for there and be in a convenient place to be removed to Richmond Hospital the next morning. Dr. Williams says he filled two ambulances with the worst wounded, and rode ahead to Hazlegrove to have fires lighted in the rooms before the ambulances got there. He had that done, and was coming out into the roads to meet and help get the wounded prisoners out of the ambulances and into the house. Whilst listening down the Atlee road for his ambulances, he heard cavalry coming up the Richmond road, and were very soon upon the ground.

"Who are you?" demanded a cavalryman in front of the squadron.

"I am Dr. Thos. Williams, Confederate States Surgeon, in charge of the Federal wounded prisoners, captured, by Gen. Hampton's command, near Atlee a few hours ago."

The cavalryman dismounted, and taking Dr. Williams by the arm, escorted him across the road, remarking to an officer on opposite side of the road, and who was talking to the wounded prisoners in the ambulances, which had in the meantime come up: "Col. Dahlgren, I have a prisoner here for you."

Col. Dahlgren, turning toward Dr. Williams, under guard, said: "Who have you there?" Dr. Williams answered: "I am Dr. Williams, of Second North Carolina Regiment, in charge of the Federal soldiers wounded in the battle near Atlee."

Col. Dahlgren courteously conversed for several minutes with Dr. Williams, getting all the information he could about the battle and situation of things pertaining to the movements of Gen. Kilpatrick and Gen. Hampton. "Well," said Col. Dahlgren to the guard, "we'd best leave Dr. Williams here to take care of those wounded men. What do you think of it, sir?" said he to Dr. Williams.

Dr. Williams, in the happiest manner, answered: "That would surely be the very best thing you could possibly do, and I assure you," continued Dr. Williams, "that I shall do my best to care for your people and have them very soon placed

ERECTING SHOP—BALDWIN'S.

properly in Richmond hospitals." Dr. Williams begged of Col. Dahlgren the favor of retaining his horse, which request Col. Dahlgren granted. "One more favor," said Dr. Williams; "will you please not allow this house [which was by this time surrounded by Col. Dahlgren's men] to be pillaged, as it will require all the stimulants here for your wounded men?"

Col. Dahlgren not only granted his request, but sat there on his horse until nearly every one of his men had moved on ahead on the road leading to Peake station, on the Virginia Central Railroad.

Dr. Williams wishes it put on record that Col. Dahlgren treated him most courteously.

Asking Dr. Williams, just before he bade him "Good morning," what he thought of his (Col. Dahlgren's) prospects of making his way, Dr. Williams told him that "it seems to be very unfavorable," so far as he was able to judge, and bade him good-bye.

Again referring to how richly furnished were the soldiers of Gen. Kilpatrick's command, and how completely they were surprised and demoralized by the unannounced night attack of Gen. Hampton, whilst they, tired and worn out, lay around their campfires asleep, that cold, rainy, sleety night, in the woods near Atlee. The next morning after the battle, the whole neighborhood was assembled on the battlefield, picking up such valuables as they could find which the fleeing cavalry had lost, and which our men had not time to find nor cared to lug. One poor but highly respected lady found a purse full of greenbacks. She was so delighted that she told everybody. One of her neighbors kindly (for he had no idea of defrauding her) told her that he would exchange Confederate money with her for the greenbacks. She, still more delighted, gladly accepted his offer, thanking him for his kindness. Another neighbor, better posted on the currencies of the two contending governments, told her that she had made a great mistake. "You go right over," said he to her, "and ask him to let you have the greenbacks, and you give him back the Confederate money and bring the greenbacks to me." She took his advice. She soon returned with the greenbacks. "And now," said she to her friend, "I want you to buy that piece of land," telling him all about which land it was, to whom it belonged, and how badly she wanted to have it. So he took the money and went at once to see the owner of the piece of land, and asked him what he would take in greenbacks for it.

"I don't care to sell it," said the owner, "for greenbacks; but I'll take $1,000 in Confederate money, cash, for the place."

"All right," answered the lady's friend, "I'll take the place, and will be here with the money day after to-morrow." He took the greenbacks to Richmond, and got in exchange for the greenbacks $1,050 in Confederate money, which he took to the owner of the land, and paid for, got deed for, and gave it to the lady. When her husband, who was a Confederate soldier, returned from the war, she had a home for him, upon which they have ever since lived, and have raised a large family of worthy sons and daughters. "It's an ill wind that blows no good."

But I must close. "Here's to your health and your families'—may you all live long and prosper!" as I heard from the lips of Joseph Jefferson, in Richmond Theater, thirty-seven years ago. By the way, allow me space to tell an anecdote of Mr. Jefferson, which happened in old Richmond Theater during the theatrical season of 1860-1861. Sectional feeling was at its hight. Mr. Jefferson, it seems, had, whilst on the Baltimore stage, let fall some remark which the Southern press considered as reflecting on the South. So when it was announced in the papers that Mr. Jefferson was to appear on the Richmond stage, it was the talk of the town that the boys would egg him. I remember I fixed my mind to see what I had never seen, and, by the way, never yet saw—an egging. The theater was crowded. The orchestra had played "Reveille." The curtain rose. It was as still as death. Quietly and firmly stepped Mr. Jefferson on the stage from the right side. So perfect an actor was he that, as he stood with his face partially turned toward the audience and raised his eyes, one could almost hear him say: "Boys, I am waiting for the eggs." But instead of egging, he received the most vociferous applause and flattering reception. He filled his engagement for the season, and is to this late day the most popular actor that ever played before a Richmond audience.

Merry Christmas, and happy and prosperous New Year to you all!

"Freak" Locomotives—No. 1.

The name "freak" seems to fit any mechanical absurdity better than a longer and more dignified word would, and, as used, is not intended to intimate that the inventors were in all cases fit subjects for a lunatic asylum. This is particularly true of the earlier monstrosities, such as is shown in the first engraving of the series, which appears in this issue.

The early builders had little to pattern after, and might possibly be excused for adopting some of the peculiar designs, although there is little excuse for anyone's "pushing around a corner," when it can just as well be done in a straight line.

The "Earl of Airlie" was not the first, and possibly not the worst, example of this type; but as an example of how not to do it, the engine was a success. It was built by Carmichael, of Dundee, Scotland, in 1833, and ran on the Dundee & Newtyle Railroad. It had the distinction of being the first British-made locomotive with the "bogie" truck principle.

Its single drivers were 4 feet 6 inches in diameter, and were forward of the truck wheels. The vertical cylinders were 11 inches in diameter by 18 inches stroke.

It must not be understood that these charts are for the purpose of ridiculing any engines or inventor, or solely for the amusement of our readers, for such is not the case. The object in presenting them is, to illustrate the immense amount of time and money that have been sacrificed in building engines which are unmechanical in design and principle, and which can serve no other useful purpose than as an object-lesson or warning.

As we learn (in too small a measure) by the mistakes of others, it is hoped these may be the means of turning ingenuity into useful channels, rather than allowing it to be wasted in trying to devise "something different," whether it presents merit or not.

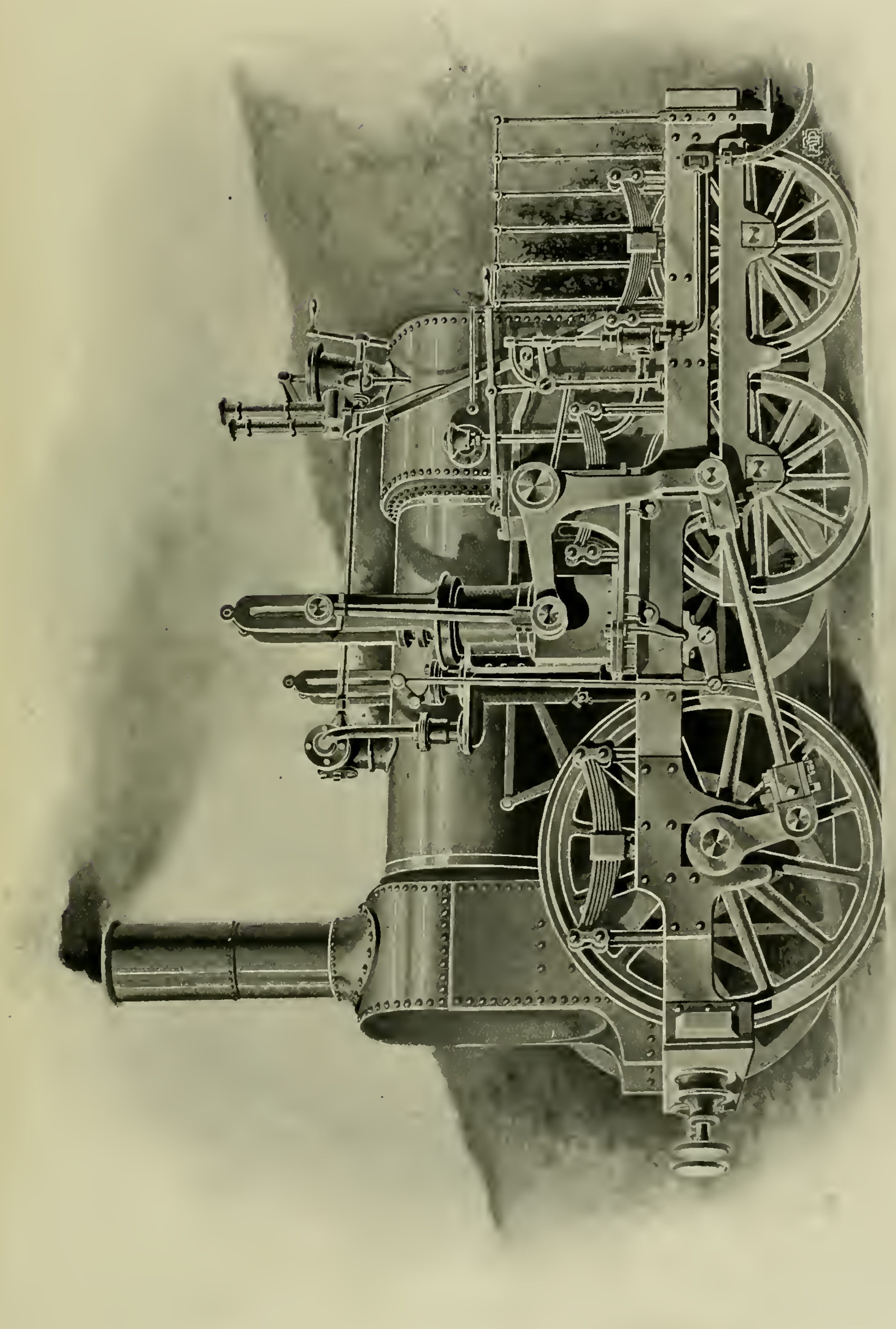
Ladies in Sleeping Cars.

Sleeping cars were for several years held for the exclusive use of men, women not being admitted to their sacred precincts. The first break in this rule was made in favor of Mrs. Lincoln, wife of President Lincoln. When she was on her way from the West to Washington, in 1861, the Wagner Car Company put a sleeping car at her disposal, and it was used in the journey from Buffalo to Washington.

With some people ladies are not yet welcome inmates of a sleeping car. "What kind of a crowd have you to-night?" asked a brakeman of a sleeping-car porter. "A poah lot," answers the porter, resentfully; "only a lot of women. The whole crowd am not wuth a dollah." Ladies do not fall into the tipping habit readily.

The Pennsylvania Railroad Company has not built many new cars this year, except to keep its numbers filled up and to replace those that are worn out. It is said, however, that orders will soon be issued for the construction of 500 gondola coal cars. This work is to be done by the railroad company, and it is said it will be given to the shop at Altoona.

A local paper says that pneumatic power is superseding steam in the machine shops of the Grand Rapids & Indiana, at Grand Rapids, Mich. From what we know, this superseding of steam by pneumatic power is very much the same as superseding it by electricity. Pneumatic appliances are used for doing the details of the work, and the old steam engine which is reported so rapidly falling into disrepute, hammers away in an obscure corner, compressing the air that the pneumatic appliances use up. The same process goes on when an electric dynamo is the distributor of the power.



FADS AND FANCIES IN LOCOMOTIVE BUILDING—No. 1.

THE "EARL OF AIRLIE," 1833.

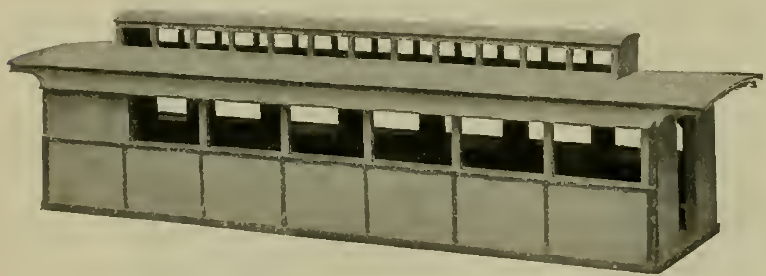
Car Department.

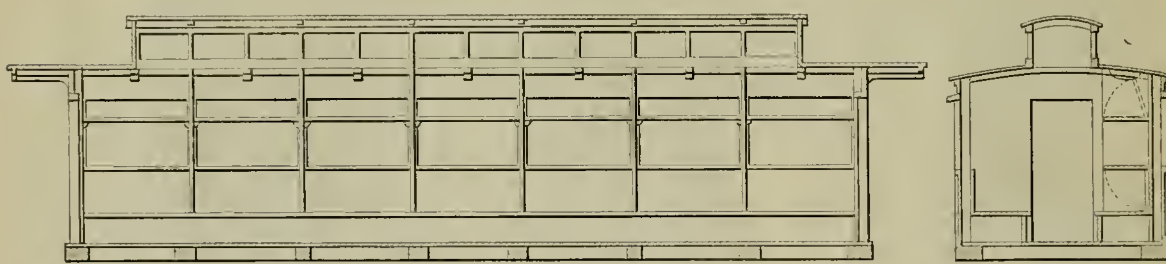
CONDUCTED BY O. H. REYNOLDS.

A Pioneer Sleeping Car.

Through the kindness of the Baldwin Locomotive Works, we are enabled to illustrate a very important and interesting thing in connection with the development of the American car.

There is in the museum of the Baldwin Locomotive Works a model of the car from which the photograph and drawings were taken. The car was built in 1840 by Richard Imbray and Jacob Dash, car builders, Bush Hill, Philadelphia. It will be seen by an examination of the cross section that the car had three sleeping berths, one above the other on one side and seats on the other. It also had a monitor roof, which was invented repeatedly afterwards, until it became a recognized feature of American car construction.





SLEEPING CAR BUILT IN 1840.

The Steel Car.

The time has arrived when the steel car has reached that period in its evolution, when opposition to the inevitable has practically ceased, or is, in any event, too weak to stay its further progress, and since it has proved itself superior to the wiles of the obstructionists, its friends are casting about for means to put its construction on a correct mechanical footing; for it is well known to those who have kept pace with its growth, that there are as many different ideas in framing as there are builders of this type of car; few, to be sure, but still lacking that uniformity that bespeaks a near approach to standard lines.

Experiments so far made with steel cars, to determine, approximately, their cost of maintenance and general fitness, were made, undoubtedly, like all other attempts of the kind, not without certain misgivings as to results; but the experimental stage is passed, as is shown by the increasing number now in use, and by the orders about to be filled. The question now is not whether we shall have steel cars, but what shall be the preferable form for the members of the car—a very vital question when viewed from the standpoint of strength, weight and interchangeability of parts, all of which will exercise a great influence on the first, as well as subsequent expense.

This matter of forms and dimensions is in hand by a committee of the Master Car Builders' Association at the present time, with a good prospect of their formulating a report that will be based on the practical opinion of the members of the above body, and will therefore comprise the information sought for, in part at least; their circular inviting an expression of opinion being framed for that purpose. The real difficulties attending a report of this kind are always aggravated by the wide difference of views held in matters involving design; on this account much calculation will be necessary to reach an actual knowledge of comparative value of the numerous sections that will be proposed for consideration for use as sills, posts, braces, and so on through all the members of the body.

As to the use of rolled commercial shapes, much can be said for and against their adoption in car construction. There are, no doubt, situations where they would fill all requirements as well as specially designed sections; but for all sills the channel section pressed to shape is, without doubt, the best solution of the sill problem, for the reason that a theoretically correct shape can be given to those parts, to carry the load with the least weight of material, by making the depth at the center and ends correspond to the ideal shape for a loaded beam. This cannot be done with standard rolled shapes without resorting to an expensive building-up process. Sills thus pressed to a form found by calculation to be correct for the rated capacity of the car—that is, deep at the center and shallow at the ends—have the additional recommendation that they make truss rods unnecessary, except in case of extremely long cars of heavy capacity.

The steel car is destined to be permanently identified with our carrying trade, because it is a business proposition. Time will be used, lots of it, before it will arrive at that satisfactory status that it will be a finished creation; but it will not be as long as was the wooden car in working up to its present standard.

Illinois Central Parlor-Cafe Car.

The Illinois Central have put on their Chicago & St. Louis division a new composite parlor-café car which is exciting much admiring comment. The car is finished in mahogany, with darker panels of the same, the latter being richly inlaid with marquetry, composed of various shaded woods. Its furnishing includes easy, luxurious, revolving arm chairs, upholstered with green frieze plush. The ceilings, in which are fixed brilliant Pintsch gas chandeliers of the latest pattern, are decorated in gold, and in color and design are in harmony, as also is the rich Wilton carpet on the floor, with the plush and mahogany finish of the rest of the room. The café is in general design and color scheme in harmony with the parlor, and has tables at which parties of four can be seated, and tables at which couples can dine tete-a-tete. A complete kitchen adjoins the café, and meals will be served en route from a varied menu at reasonable prices. The café feature is to be conducted in the same general way—for patrons of the entire train—as are the café cars on the same line running west out of Chicago and which have proved so popular. The car also contains a gentlemen's smoking-room, in connection with which is a buffet, from which cigars and liquid refreshments can be obtained.

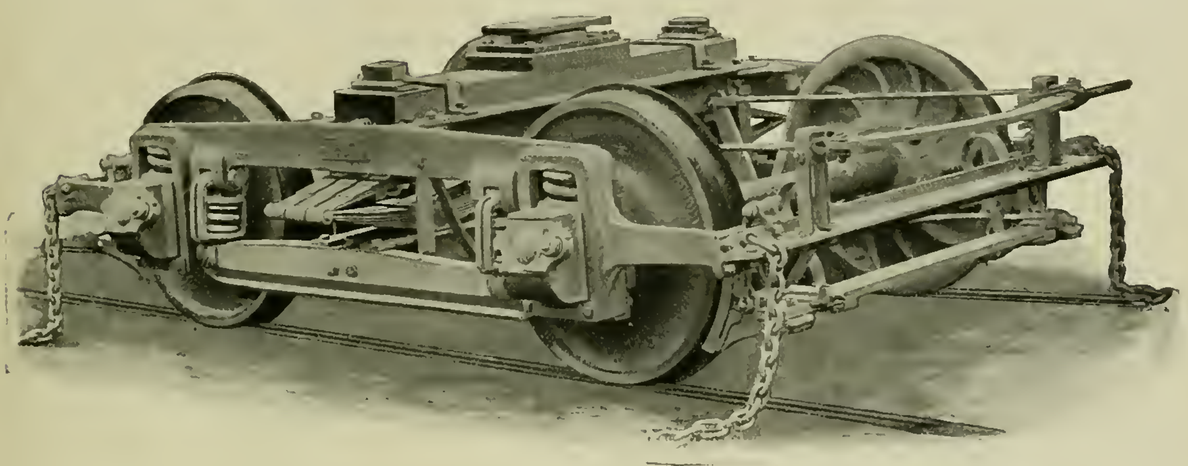


Fig. 1. BRILL TRUCK.

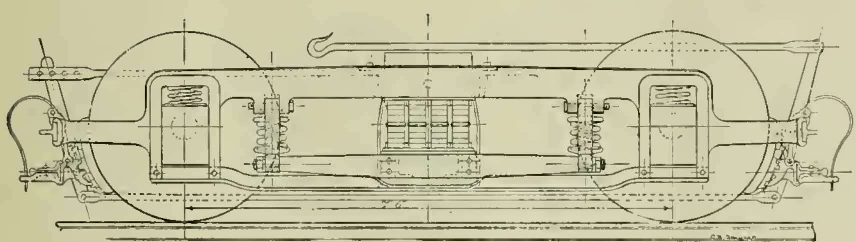


Fig. 2. BRILL TRUCK.

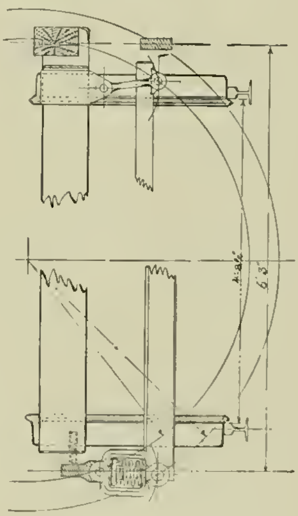


Fig. 3. BRILL TRUCK.

The Brill No. 27 Truck.

The passenger car truck shown in Fig. 1 is the result of much research and thought in the determination to have a truck perfect for several trying conditions, among which are absolute immunity from derailment, ease of running in traversing curves, and an entire absence of shock in the car body under all circumstances. What had been done in this direction was only an incentive to renewed effort in devising a truck that should embody all of the above desirable points.

In order to meet the requirements which experience had shown must be provided for, a rigid wrought-iron frame to hold the wheels square is made as a foundation on which to build; wood has no place in the construction of the frame, and this is a radical leave-taking of one of the old and solidly intrenched features of all passenger trucks up to the present time. The frame has jaws forged on, with extensions to receive the tie member at the ends, which makes the frame continuous around the wheels. The equalizers are secured to, and are a part of the spring plank, taking the load on the body bolsters at the center of their length. The load is transmitted from the equalizers to the journals by means of swinging links at the ends of the equalizers, which are pivoted to the frame at their upper ends in jaws forged on the frame. Fig. 2 shows these points plainly.

The number and arrangement of the springs are the factors on which reliance is placed for smooth action. There are helical springs between the frame and the top of journal box, and also between the equalizer and frame, besides the elliptic springs under the bolster. By this means all side shocks are absorbed in the springs before the bolster can reach the frame, and this is accomplished without interfering in the least with vertical equalization. This feature of the truck is unique, and to it must be ascribed its remarkable success in curving and remaining on the rails on the roughest track, because of the fact that the load on the springs over the boxes is distributed to them by the swinging equalizer springs, and this gives the longitudinal stability so necessary to easy and safe action under shocks, and to a degree far greater than with old equalizing arrangements, all due to the great distance apart of the swinging equalizing springs.

An idea of the lateral stability of the truck may be gained by an inspection of Fig. 3, which shows the M. C. B. standard spread of hangers on the right side of the engraving, while the new truck is shown on the left. The circular arcs struck from the center plate in the case of the latter, and from the center of the old-style hanger, shows the relative length of radii through which lateral action occurs in either case. In the matter of brake thrust, while an outside-hung brake on the ordinary truck exercises a tilting effect to the annoyance and discomfort of passengers, the same hung brake on the new truck has no appreciable tilting movement.

The truck and method of equalizing, taken as a whole, mark a distinct advance in truck design. It has proven its worth in suburban, interurban and elevated service—built on lighter lines, of course—and there is no good reason why their use will not become general on steam roads. Their record, thus far, in heavy electric traction and on steam roads, has been of the most satisfactory character. As an earnest that the Brill Company mean to have their truck in service under heavy passenger equipment, they have designed the truck described, and there is no doubt that it will continue to win its way to the front, for it is put up on mechanical lines, and embodies features of merit possessed by no other truck now in use under passenger cars.

Vestibule Cars in Australia.

The people of Australia have commenced to treat themselves to the luxury of first-class sleeping cars, similar to those run on our first-class roads. The Sydney *Herald* has the following notes about a train recently put in service on one of their lines:

"The Pullman vestibule sleeping cars are now a familiar and valued feature of the intercolonial express trains. For those who can afford the luxury of a sleeping berth these cars leave nothing to be desired, but there are many travelers who obtain as much rest by wrapping themselves in a railway rug and reposing in the corner seat of an ordinary railway carriage. In order to cater for the comfort and convenience of this large section of the traveling public, the Railway Commissioners have just completed the construction of four new corridor cars fitted with the Pullman vestibule attachments. They have been built at the Eveleigh Government Workshops, and are very handsome vehicles. Externally the design of the Pullman sleepers has been closely adhered to, and the interiors are fitted in the same luxurious way as the American cars. The figured white horsehair cushions of the Pullmans are repeated in the new cars; the large plate-glass windows are on the American pattern, and the lavatory and smoking-room arrangements are of similar design.

"The seating accommodation, however, is differently arranged. A long and narrow corridor extends down one side of the car, communicating with seven passenger compartments. The vehicles are 61 feet long over the bodies, 67 feet over the end platforms, and 9 feet 4¼ inches wide over the panels. The hight from floor to ceiling in the center of the lantern roof is 9 feet ¾ inch. They are carried on two six-wheeled bogies, which have each a wheel base of 10 feet. The bogie centers are 46 feet apart, and the total wheel base is 56 feet.

"Each car is fitted with vestibule ends and side passage, giving continuous communication throughout the train, and divided into seven passenger compartments, viz., five compartments, centrally situated with seats divided by arm rests for six persons; a ladies' boudoir, with seats for nine persons arranged at one end, and at the other end a smoking saloon with seats for six persons. The total seating room in each car accommodates forty-five passengers, viz., twelve smokers and thirty-three non-smokers. The requisite lavatory accommodation is provided at each end. The passenger compartments are entered by doors opening into the corridors. They are well lighted by compressed gas carried in reservoirs beneath the floors of the vehicles, and fitted with the Westinghouse continuous automatic brake. These cars will start running next week in conjunction with the Pullman sleepers on the Melbourne express."

The Erie Steam Motor Car.

From information just at hand, we are led to believe that the Erie Railroad was one of the first roads, if not the first, to put in service the steam motor car for passenger traffic. In 1858 such a car was built to run between Paterson, N. J., and Jersey City, in the suburban trade, by Mr. C. A. Smith, then master car builder of the Erie.

The car was built with wooden sills and iron posts, in general appearance like the standard coaches of the road, but sheathed on the outside with sheet iron. The body was divided into two compartments, one of which was fitted up for the comfort and convenience of sixty people, and the other containing the engines and boiler.

This car gave excellent service, and was popular with the suburbanites when in use; but the company, while satisfied with its performance, could not spare the wherewithal at that time to make the service complete with motor cars exclusively, and the sample car was taken off the New York end, and run between Binghamton and Hornellsville.

After a term of service between those two points, the engines were taken out, and the car was transferred into a smoker and run in the through trains; it finally reached its finish as a passenger car by being set out at Attica, N. Y., as a shelter and headquarters for a section gang, where it remains to this day. Reminiscences of this kind tend to strengthen the belief that there is "nothing new under the sun."

A Handsome Private Car.

The car built for the exclusive use of Sir Charles Rivers Wilson, president of the Grand Trunk Railway, is in many respects one of the finest cars of the kind, in the way of conveniences for those making it a home, and also in the quiet taste displayed in interior ornamentation. The selection of wood shows the discrimination of a connoisseur in producing pleasing effects, and what is lacking in grains is more than offset by carvings of the most exquisite design.

The observation room is little different from other rooms used for the purpose, except that the usual maps on rolls are not visible, they rolling up and disappearing between the head lining and roof. Two state rooms are next, one of which is finished in white mahogany, and the other in dark mahogany; these two rooms are en suite; both have elegant metallic-frame single beds, and the first is fitted with a bath, let into the floor in the center of the room. Lifting a panel or section of the floor discloses the tub and all accessories for the enjoyment of a bath unrestricted for room—a much better arrangement than can be obtained with the usual pinched quarters allotted to the purpose in official cars.

Next to these rooms, and in the center of the car, is the dining room, which is finished in quarter-sawed oak. The sideboard is unique, in that the central part is built so as to fall and form a desk, having the usual little kinks to make the stenographer feel at home. Two other state rooms, one for guests and one for the butler's pantry, comprise the remaining rooms, after which comes the kitchen, one of the best designed places for getting up a meal of the rectangular order we have ever inspected. The car was built at the Grand Trunk shops, which accounts for the fact that it could not be any better or finer for the purpose of an official car.

How Coal Was Probably Formed.

M. Fayol, an eminent French engineer, having in charge the coal mines at Commentry, advances the following theory of the formation of coal, claimed to be based on such facts and experiments as receive the support of scientific men; the mines in question, being partly worked in the open air, have rendered it easy to observe the relations of the different strata making up that region. It appearing at first that the pebbles constituting the pudding stones were formed of rocks whose place of origin was sometimes quite distant, and the coal being the result of vegetable debris laid down in horizontal layers, one above the other, the conclusion arrived at from these data assumed that a liquid must have been necessary to transport and arrange in this way such different elements—coal, therefore, not having been formed in the place where now found, but is a product of transportation. It is urged that the climate of the coal epoch being very moist, abundant floods carried away trees and whole forests and swept them into lake basins, the trees thus forming great rafts of logs; the heaviest materials—gravel, sand, clays—were deposited in the order of their density, the lighter vegetable matter floating longer and being deposited last. This, it is thought, explains why the layers of earth and coal are not parallel, and why all those layers, as has been observed in deltas, are inclined in the same direction and at different angles.

Freight train No. 91, West bound, and 92, East bound, over the Wabash, cover 342 miles in sixteen hours, and the transportation department claims this is the fastest freight schedule in the country.

Practical Letters from Practical Men.

All letters in this Department must have name of author attached.

Headlights.

Editors:

The locomotive headlight is a great help to an engineer, if it is in perfect order; when it is not in order, it is a great annoyance. Now a headlight is constructed on scientific principles, both as to the means for making the proper light and for directing the light where it will be of the most use. The curve of the reflector, from the back part or center towards the edge, should be such that all the rays of light from the flame will be reflected straight ahead where they are needed. All rays of light follow a natural law, traveling in a straight line till they strike some surface that reflects them, then they take a new course and follow a new straight line. This is called the law of "incidence and reflection," and to throw the rays of light straight ahead, the reflector should be a perfect "parabola curve" from the bottom to the edge. Reflectors are generally of this curve, and the light or flame should be at a certain point near the bottom of the reflector, called the "focus" or focal point, in order to get the best results from the light. If the flame comes exactly in the focus of the reflector, the rays of light will all go straight ahead; but if the burner is even a little to one side, the light will, most of it, go to the sides of the track. As the flame is an inch or two in diameter, some of it will go to one side, anyhow. When a headlight burns brightly, but gives a very poor light ahead, very likely the burner and oil tube have been soldered to the oil tank wrong, and they should be changed to the right place. As fixing the burner at the right point is quite an expert job, even for the headlight makers, directions cannot be given here; but a headlight that gives a satisfactory light can be measured up and the proper distance from the back of the reflector arrived at. The middle of the button is about in the middle of the flame, so the middle of the button should be about in the focus. Some makers place them a little ahead of and level with this point. (See Fig. 1, which shows burner wrong, and Fig. 2, which shows it in the right place.)

A white surface reflects light best; therefore we use silver, which is the purest white to be obtained in a metallic surface, for the coating of the reflector. For the same reason, the inside of the case and the back of the reflector are painted white, if we wish to have the light show through the engine numbers in the case. Painting the case and back of the reflector white does just as well to show the numbers as cutting holes in the reflector, and does not take away any of the surface of the reflector.

Try the paint first before you cut the holes. The ring that the glass sets in should be painted white. When any of the white paint gets smoked up or dirty, have it made white again. White reflects light; black absorbs it.

Where the headlight sets very high up from the rail, it is a good plan to tip the top of the case forward a little and wedge up under the back edge; this will tend to throw the light down on the track more, where it is needed. It does not do so well to tip the reflector in the case for this purpose, as the glass and ring should be square with the reflector if you wish the light to go straight ahead.

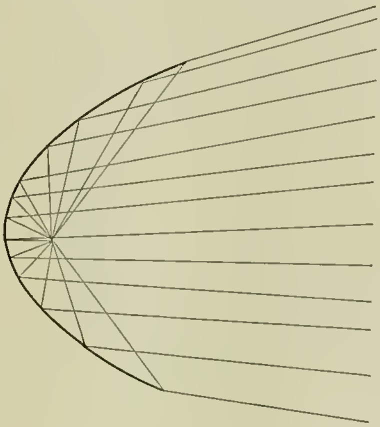
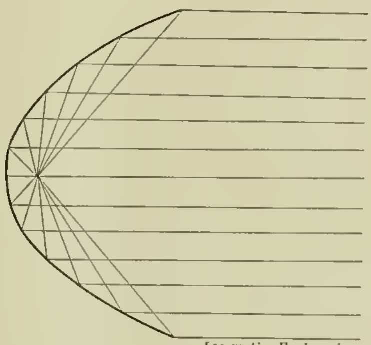


Fig. 1



Locomotive Engineering

Fig. 2

CONDITION OF BURNERS.

There are so many troubles incident to poor headlights, and the causes are so obscure, that no one who has ever had the care of headlights will attempt to doctor them for smoking or burning poorly, till he has examined the one in question when it is in actual service.

A headlight flame is something like a bright fire in the firebox—if you want a white fire, you must obtain perfect combustion. This takes good fuel, a proper supply of air both below and above the blaze; the draft must be just right, or too much of the blaze will want to go towards the top of the chimney. There is a current of air coming up inside of the wick tube which feeds the flame from the inside, and the button is used to throw this air against the flame of the burning oil, so the combustion will be perfect. Another current goes up outside the flame inside the chimney. Unless these air passages are kept clean and free from oil in the gauze, do not expect a perfect light. If the draft up through the wick tube is choked too much, the flame will close in around the button and smoke out of the top of the chimney; if it does not get enough air between the burner and outside of the flame, the chimney will melt out in short order.

If the draft into the case at the bottom is choked up, when standing still it may not let in air enough to keep the wick tube cool and supply fresh air to the flame for perfect combustion. With the engine in motion, it may have a forced draft which is just right to make it burn good; or it may be the other way—the forced draft may put the light out altogether. If your light bothers you while running, see if the opening under the case is stopped up, either front or back. If open in front and stopped up back, when running ahead, it will force the air up into the case, and in going out of the case at the top, it must affect the draft.

A stoppage in the ventilator at the top of the case will cause the light to smoke. This may be caused by soot, or by the top being smashed in so the openings are restricted. If stopped with soot, a hose connection to the air pipe at the pilot, or a steam hose, comes handy.

If the chimneys break off at the top end, see if the springs that hold them from striking the edge of the hole in the reflector are not weak.

It is nothing unusual to have a headlight wick work down when running. To remedy this, pack the gland a little tighter around the shaft of the wheel that turns up the wick, so that it can't turn so easy.

Sometimes a wick that is too thin and loose will make a light smoke; the flame will flare and jump when running; besides, the oil will work out and run down the wick tube. A wick should be just loose enough, so it can be turned up and down easily. Very often there is so much thread around the wick to fasten it to the holder, or the knots are too large, so that it moves hard when it is too thin for good service.

Some of the knit wicks made the exact size to go over the wick holder, are good; others are not—they are not always made of good material.

Felt wicks are joined on one side by sewing the edges of a flat piece together. Unless this is very neatly done, it leaves an opening at one side in the flame. The old-fashioned cotton-flannel wick, when properly put in, is about as good as any, as the material is the same all around the wick—a matter of considerable importance, if you wish to have the flame burn an even light all around.

When you put in a new wick, empty all the oil out of the oil tank through the wick tube; this will clean out any sediment there may be in the oil passage. If any water gets in the oil, it settles to the bottom and fills up the passage, as it is heavier than the oil, and keeps the oil away from the wick. A couple of teaspoonfuls of water will hold the oil back so the light will not burn. Look out for this matter.

A headlight wick gives better service if it is not turned up and down when the light is put out. If turned down, instead of blown out, the next time it is lit you have to set it by guess, and after it gets warm, turn it up or down to suit. If it is blown out, the wick is left just the right hight to burn good the next time it is lit. Therefore it pays to have a piece of small pipe in the case, bent the right shape, to blow into the chimney to put it out.

The film of silver on a reflector is very thin, so a few scourings with coarse material will expose the copper. Lampblack and a little oil is sharp enough to scour it with; then polish it with dry lampblack. Look out for foreign substances in the waste that will scratch the silver, and never use tripoli or whiting on it.

Pay no attention to the man who wants to sell some patent polish that will scour off or dissolve all the silver on a reflector in a few applications. A headlight must be handled almost as gently as a little child.

Remember, when you see someone else spoiling a good reflector, that headlights are changed around from one engine to another a good deal, and you may have that light yourself some time soon.

CLINTON B. CONGER.

Smith's Roller Balanced Valve.

Editors:

I would like to be accorded space in your journal for an airing of a new form of balance valves, known as the Smith roller balance valve. The invention consists principally of a rocking valve provided with a cavity adapted to connect the interior of the steam chest with the cylinder port, and the latter with an exhaust chamber.

Fig. 1 of the accompanying drawing is a sectional side elevation of the improvement.

Fig. 2 represents the valve as incased in the steam chest.

Fig. 3 is a sectional plan view of the same, with the valve stem and link removed, also the exhaust chamber bridge.

Fig. 4 is a sectional view of stem and connection link.

The cylinder is provided with the usual inlet ports and the exhaust port; the valve seats being segmental, adapted to receive the cylindrical valves *D* and D^1, respectively, as shown in Fig. 1, having their ends journaled in the sides of the valve body and in the cap. The exhaust port opens into a chamber formed within the valve body and between the two valves *D* and D^1; the top of the chamber being closed by a transversely extending bridge forming part of the cap, and having its side edges bearing on the peripheral surfaces of the cylindrical valves *D* and D^1.

The valves *D* and D^1 are formed in their peripheries, with cavities or recesses D^2 and D^3, respectively, arranged in such a manner that when the valves are rocked in their bearings, then the cavities alternately connect the interior of the steam chest with the corresponding cylinder port, and the ports with the exhaust chamber. In order to impart a rocking motion to the cylinder valves *D* and D^1, the following device is provided: On top of the valves are secured upwardly extending lugs which carry a transversely extending pin on which is pivoted a link engaging at its forward end the rounded portion of a pin carried in the lugs. The pin at valve D^1 is formed with the squared portions fitting in vertically extending recesses arranged in the head of the valve stem.

By reference to Figs. 1 and 2, it will be seen that the major portion of the peripheral surface of the valves *D* and D^1 is at all times exposed to live steam in the steam chest, so that the valves are completely counterbalanced.

I would like to bring this matter before the readers of your paper, and ask for criticisms. There is an engine now being fitted up for trial at Mt. Vernon, O., owned by the C. A. & C. R. R., with this valve, using a 5-inch roll.

C. F. HAMMOND.

Frankfort, Ind.

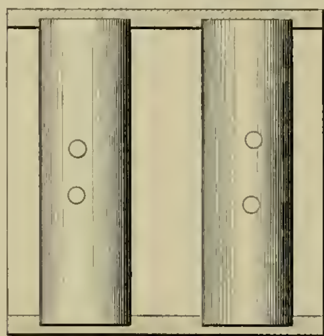


Fig. 3

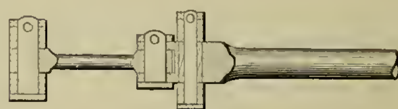


Fig. 4

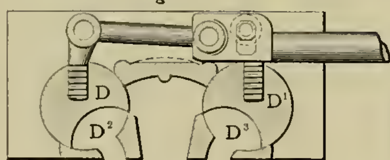
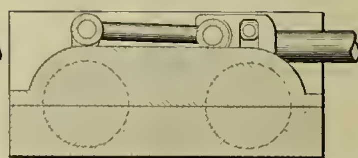


Fig. 1



Locomotive Engineering

Fig. 2

SMITH'S ROLLER BALANCED VALVE.

Progress in the Blacksmith Shop.

Editors:

When we look upon forgings we should look upon proper material, for it is not always the methods of manipulation that we need to take into account. How the form of the forging may be brought about under the various materials, such as iron and steel, matters little in so far as the usefulness and the endurance of the article is concerned. But what we do need to take into account is the uses and abuses to which all forgings are subjected in a more or less degree. And, in point of fact, we know that the blacksmith is not authorized at all times to make use of this principle. Furthermore, the blacksmith is not always a good judge of this principle; he oftentimes is a victim of the dogmas of the past. If he is a good mechanic, he will know how to handle material; and I cannot see but he would add to his dignity and prestige if he increased his resources as to the principle of the material he comes in contact with—in this way he will obtain different values.

It is important for the blacksmith to know when steel will have additional advantages over iron, and vice versa. Of course, in these academic days, some will say that is not the province of the blacksmith; but I hold that a blacksmith with observations extending over many years concerning his art, has peculiar facilities for studying the natural dispositions of iron and steel. He has opportunities for knowing the different qualities of iron and steel best suitable for certain purposes. If he has a mill cutter to forge, he should know the proper grade of steel that will answer best. In a forging that is subject to great strain or shock, he should understand the proper material that will best withstand said strain or shock; and if the shape or form of forging is left to his judgment, he should know how to place the material so as to give the greatest strength, and thereby obtain the best results. By that I mean forgings should be so designed as to overcome resistance, and yet be in conformity with the general law of good proportion. For example, many smiths, in making a wrench, will place the stock where there is no resistance and leave an inefficiency where there is the most resistance. We have striking examples like this in many forgings. To make a neat forging is an artistic piece of work, and requires a natural taste. It is utterly impossible for some smiths to make a proportionate forging; in shop parlance, "they have not got it in their eye."

I have endeavored to dwell somewhat from the standpoint of hand-made forgings. From the points of industrial progression, new methods are ushering in a change so rapidly that in a short time a hand-made forging will be a thing of the past. The anvil in many instances has been replaced by the various machines now in use, and possibly it is only a question of time when tongs, as the only object of the past, will deserve respect.

George F. Hinkens.

St. Paul, Minn.

More Information about Louisville Shop Tools.

Editors:

Just say to Mr. Reynolds that I will break his back the first time I see him.

In illustrating the eccentric boring tool, he says, "The roughing-out is done with an ordinary boring tool, but the fine work, the operation that produces the accuracy aimed at, is left for the boring bar shown in detail." Allow me to say that this roughing-out is done with this same kind of a cat-head, we having two for each size of axle. The one for roughing out has to be ground occasionally, while the one for finishing very seldom has to be reground; but we can rough out six eccentrics with this tool while we were roughing out one with an ordinary boring tool. As we have reduced the diameter of the eccentric fits of all our large engines to two sizes, and all eccentrics for the entire system are bored and turned at one shop, the outfit is not very expensive.

He has certainly exploited the different devices we use in our blacksmith shop quite extensively; but if he should turn up again, we will show him that there have been a great many new devices added since he was here.

Enclosed please find money order for $2 to renew my subscription.

P. Leeds, S. M. P.

Louisville, Ky.

The U. P. Engine.

Editors:

The picture of the U. P. boiler head and the dandy engineer on the "brotherhood" seat are all very fine; but before the critter tries to do something, would it not be a good idea to move that reverse lever just a leetle one way or t'other?

W. de Sanno.

Tulare, Cal.

[We are surprised at the criticism made by Brother de Sanno. Can't he see that the reverse lever is in the position it ought to be in when the engineer sits with his eagle eye embracing the space that the engine is putting behind at the rate of sixty miles an hour? Does our critic want to make that speed with the lever in the corner?—Ed.]

Draft Equalizer.

Editors:

I noticed in your October issue of Locomotive Engineering a description of a double smokestack now on trial on a locomotive in England, with which they were experimenting. I enclose to you a descriptive circular which will give you all the information necessary to explain the working of a double smokestack for locomotive, patented by me, and has been in use on a number of locomotives on the Toledo, Peoria & Western Railroad for the past two and a half years, and given good satisfaction.

The principal claims for this arrangement are: Greater draft on sides of boiler; produce greater amount of steam with larger exhaust nozzles, thereby reducing back pressure; greater speed with less weight of motive power; 40 per cent. larger area of smokestack openings; 20 per cent. larger area of exhaust nozzle opening; saving in fuel; saving on wear of boiler flues; greater steaming capacities with smaller boilers.

This is sent, thinking it might interest yourself and readers.

W. B. Warren,
Gen'l Foreman, T., P. & W. R. R.

Peoria, Ill.

WARREN'S DRAFT EQUALIZER.

Feeding Flake Graphite to Cylinder

Editors:

We notice in Locomotive Engineering of November, page 51, your reply to "J. B.," of Peoria, Ill., who asks if Dixon's Pure Flake Graphite mixed with tallow would feed in a Nathan lubricator, and if the same graphite finely pulverized is as good for the purpose as the flake. You have made a very satisfactory answer, and we should like to supplement it with the remark, that the Dixon flake graphite is sent out in pulverized form; that is, we use the word "pulverized" simply to indicate its fineness, but even when pulverized it is still a flake, and shows as such under a magnifying glass. The flake graphite is considered preferable, no matter what its degree of pulverization may be, because of the fact that the minute flakes form a veneer-like coating on the bearing surfaces, making an exceedingly smooth bearing.

A very clever way of introducing graphite into engine cylinders has been found by many engineers. It is to mix the graphite with oil, or even a little water—oil is preferable, we believe—and hold the cup or vessel in which it is mixed under the relief valve. The mixture is readily sucked into the cylinder and lubricates the cylinder perfectly. We think that one engineer told us that he used the top or lid of an oil cup, but are not sure, and do not want to say anything that would not be "according to Hoyle."

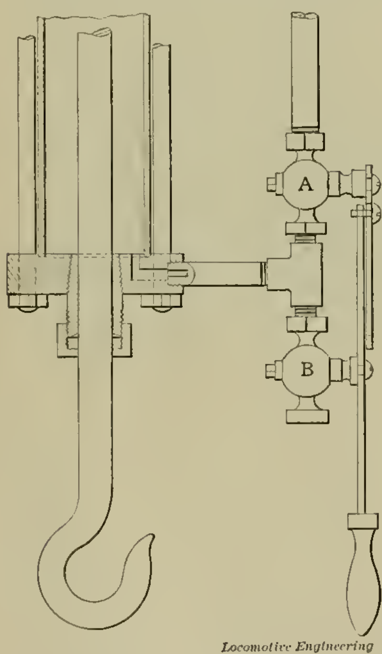
JOS. DIXON CRUCIBLE CO.

Valves for Air Hoists.

Editors:

A cheap and efficient method of operating the admission and exhaust valves of air hoists is shown in the accompanying sketch. It is made of material always at hand in any shop, consisting of a ¼-inch T and two ⅛-inch plug cocks, of which A is the admission and B the exhaust.

The plugs are actuated by two links of ⅛-inch plate iron, which are fitted to square shanks on the plugs. The upper link, shown in section, is short and slotted to receive a bolt, which is tapped solidly into the lower link to which the handle is attached. It is seen that any movement of the handle will move both valves at the same time, and by a proper arrangement of the ports in the plugs the admission will be closed slightly in advance of the exhaust opening.



VALVES FOR AIR HOISTS.

The handle is shown as arranged for a small hoist, which is always within convenient reach of the operator, and can be handled from the floor; the links are then in a vertical plane as in the engraving. When it is necessary to apply the idea to an elevated hoist, the lower link is made to be in a horizontal plane and the cords to operate it are attached to each end, the other parts remaining as shown.

J. A. EISENAKER.

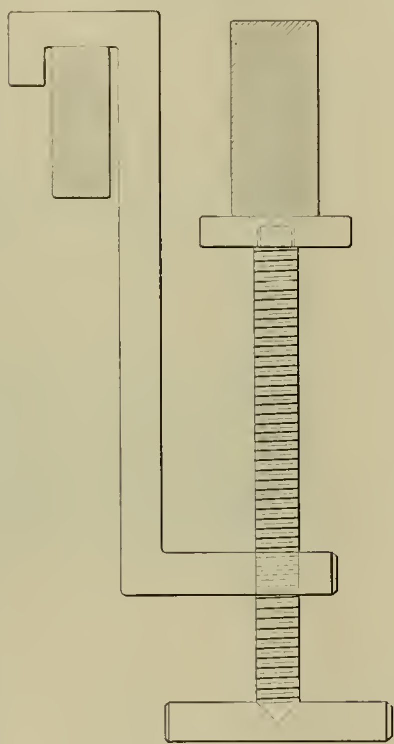
Elmira, N. Y.

Kink for Rods.

Editors:

I forward you a sketch of a kink, got up by our M. M., for holding up a rod in line, so as to readily remove or replace a strap after it has been removed for any cause, on a mogul, ten-wheeler or consolidation engine.

To use it, the wheels should be placed on the back center, and the upper end of the device hooked over the front section of the side rod, while the screw with the loose plate is brought to bear against the bottom of the main rod, as shown in the sketch.



ROD SUPPORT.

This scheme has proved a great convenience, as it holds a rod in alignment with the pin, and one man can remove brasses and return them without assistance. It is the first one I have seen, and I send it to you, believing others would appreciate it as we do. It is much lighter and easier to handle than a jack.

F. A. MITCHELL.

Stockton, Cal.

Strength of Check Chains and Hooks.

Editors:

In a recent wreck that occurred in New England, all four check-chains on one truck came into action, and all four hooks failed. The hooks, although of a form commonly used for that purpose, were very differently proportioned from large and carefully designed ones. Acting upon the suggestion of this accident, I measured the hooks and chains of three cars of three different railroads, and found that one car had hooks half as strong as the chains, while on the other two the hooks were but about one-sixth as strong as the chains.

Of course, it is difficult to design truck check-chains that will do all that is desired of them in a wreck; but that does not explain why the connection should not be of nearly uniform strength from the truck to the car body. It is conceivable that the failure of one hook might result in serious loss, where the hook would not have failed if it was as strong as the chain. Is there any reason for this apparent inconsistency in car-building practice?

G. FRANKLIN STARBUCK.

Waltham, Mass.

["A chain is as strong as its weakest link," but there is no good reason why such weakness should always appear at the hook. Too little care is given to the proper section, and also the weld at the eye of the hook. Check-chains should be subject to test before going into service, but it is open to question whether that would help the situation, as chains have been known to tear away from a car sill when strong enough in themselves to resist the stresses due to derailment. This trouble assumed such proportions a few years ago that some railroads seriously considered the abandonment of check-chains, and we believe such action was taken in a few instances.—Ed.]

Packing Injectors with Graphite or Plumbago.

Editors:

The most common material used in the packing of locomotive injector throttles is asbestos wicking. Sometimes rubber packing of various kinds is substituted; but the asbestos can probably be found in three-fourths of the injector stuffing boxes.

This material is far ahead of the candle wicking used some few years ago, making more lasting joints; but it invariably becomes hardened, cutting the stem, and that leads to leaks, profanity and more labor. If you wish to secure absolute comfort with your injector joints pack them with graphite or plumbago. Unscrew the stuffing box from the body of the injector, secure it in a vertical position, take it all apart, and clean stem, gland, etc., thoroughly; put stem in place, and put a light strand of asbestos in bottom of stuffing box; then put in your graphite, ramming down with the gland, and adding more graphite until you have the space nearly full and pressed hard; then put another light strand of asbestos on top and screw nut down on gland. When it becomes necessary to use injector, slack off gland nut until the valve works just right; then you need not give it either oil or attention, until the valve begins to work so free as to open itself, when the twelfth part of a turn of the gland nut will secure the proper tension for another sixty days. When the injector is taken apart, the stem will have a black polish that speaks for itself. This kind of packing can be used anywhere in the cab where the box to be packed can be placed in a vertical position while being worked on. It is clean and tight, working freely, and no engineer need fear that it will give out on the road.

EUGENE MCAULIFFE.
K. C., Ft. S. & M. Ry.
Springfield, Mo.

RAILWAY STATION AT PERTH, AUSTRALIA.

Roundhouse Chat.

SMALL BOILERS AND SHORT VALVE TRAVEL.

Editors:

When the boys stay around the roundhouse long enough to talk sense—get over their "jollying" each other about some mishap or other—we roundhouse men often hear some pretty good talk, arguments and discussions, which show that some of the boys are thinking about something besides the end of the run and pay-day.

The other day they were discussing the new class "L" engines—how well they run, how many cars they hauled and all that, when Billy Walters, who has studied engines pretty carefully, both here and abroad, pipes in with: "Well, they ought to; they have a monstrous boiler, as compared with English engines of the same cylinders and wheels. Of course, when it comes to boilers, too much is about right. I was looking over a new engine they've got out on the Manchester, Sheffield & Lincolnshire Railway, in England. There's lots of difference, as you can see by the figures. For the sake of easy comparison, I copied them down in the 'deadly parallel' form, like this:

	AMERICAN.	ENGLISH.
	Inches.	Inches.
Cylinders	18½ x 26	18½ x 26
Wheels	80	84
Boiler, front	62	51
Boiler, back	68	51
Flues	1⅞	1¾
Number	320	233
	Square Feet.	Square Feet.
Grate	35	20
Heating surface	1,900 (nearly)	1,209
Surface in Belpaire firebox	180	109
	Tons Coal.	Tons Coal.
Tenders carry	5	5
	Gallons Water.	Gallons Water.
Tenders carry	3,600	4,000

This sort of staggered the boys a little; but the facts were there. Bill wouldn't lie about them, even for the sake of argument.

Here was a difference of nearly 700 square feet of heating surface and 15 feet of grate surface, while the diameter of the boilers was very different, as the wagon top on the class "L" extends pretty well forward, beginning at the first sheet. Yet the cylinders are the same, and the English engine has a wheel 4 inches larger.

First everybody knew they didn't handle heavy trains; but Bill said they did—nearly as heavy as ours, and explained things something like this:

"All English engines have smaller boilers than American engines for the same work. But they have better coal, burn it to better advantage, having paid more attention to fuel economy than we have. Here it's a case of 'get there,' coal or no coal, except in some few cases. Then the English engines have copper fireboxes, which give a little better results than steel, though they probably cost more to begin with and to keep up.

"Then the English designers have

learned that a short valve travel and smaller ports give better results in locomotive practice, and have given stationary practice the 'go-by' for this work. You'll find lots of English engines with only a 4½-inch travel, and not many of them go over 5½ inches. This means less work to be done by the engine itself, and seems to handle the steam to good advantage. At any rate, they get there in good shape."

Billy may be wrong in his conclusions, but they give something to think about, at any rate.

R. E. MARKS.

Camden, N. J.

How the Compound Was Treated.

An esteemed correspondent sends us the following particulars about how a compound locomotive became so unpopular that it was changed to simple. It is one of many cases:

In reading in the December number of LOCOMOTIVE ENGINEERING, page 902, "Engineers' Views About Compound Locomotives," I was reminded of a single compound engine that was brought to the district on which I was running a few years ago. Orders came to put it in charge of the oldest man in the freight service. This man knew how to oil around and could "hit an engine" to make time, but was a failure to handle improvements unless some person drilled him thoroughly about their manipulation. The work with that engine was a failure unless a certain extra man, who was from another road and was an up-to-date student of his occupation, was sent out in charge of the engine. It had few friends, because it was not rightly handled, and the proper work was not done on it.

In talking to the travelling engineer, he told me that the cylinder packing was gone out of the high pressure side, for steam blew out of both cylinder cocks all the time. Now this will give you an idea of the show this engine had here. Seniority instead of qualification killed it. The superintendent of machinery ordered new cylinders, and it was worked over into the old style. I must say that I was sorry to see this.

Surface Railroad Men Improve Street Railway Machinery.

At a recent meeting of the New England Railroad Club, Mr. J. L. Hirt, of the Metropolitan Traction Company, New York, read a very elaborate paper on "Cable and Underground Electric Conduit Railways."

In the course of the discussion on the paper, Mr. Angus Sinclair said: "To me the paper has been interesting, more especially from the fact that a great part of the mechanism shown was developed by steam railroad men, by practical railroad mechanics. I have seen a great deal of what was shown to-night in Mr. Vreeland's office, who is president of the Metropolitan Railway and vice-president of the New York Railroad Club. Under his inspiration many of these improvements have been carried out, and some of the most important ones have been invented by Mr. Thomas Millen, whom many of you remember as having been master mechanic of the New York & Northern road and as a member of the Master Mechanics' Association. I feel gratified to see that railroad men are putting their stamp on the mechanism that is running away with the business to some extent, and if it has to be done, I should like to see such railroad men do it rather than any others. I think the details of the mechanism are rather too much for an ordinary meeting of this kind, but I followed the descriptions of them with considerable interest, and I have no doubt that all of us know a good deal more now about the cable and street railway systems than we ever did before. (Applause.)

Motive Power on the Canadian Pacific.

Mechanical Superintendent Atkinson, of the Canadian Pacific Railway, has, in the process of weeding out his old power, scrapped eighty boilers from 17 x 24 engines in the past fifteen months, and is building new work to replace them. Three Vauclain compounds are also under construction, the cylinders being made here, in one of the most complete foundry plants in the country, having an equipment to successfully handle anything in the line of cast work. The wheel department stands at the front for its work, having eighteen annealing pits, and these are sunk in a raised or built-up section at one side of the main floor, out of the way.

A curious situation has developed here, and one contrary to precedent, as that goes in railroad shop affairs. It is the result of the management asking for tenders from manufacturers of certain lines widely in use in motive-power work, Mr. Atkinson being allowed to enter with the final bid. With this privilege he has been able to put a price away below outside competition and keep the work for his men. This may be regarded as a scheme to bear the manufacturers' prices out of living profits, but it is a simple business proposition, and the fact that the managing officials demanded and received the pound of flesh, full weight, from the head of the motive-power department, shows the latter to be well organized and managed, to meet the prices of old-established manufacturing plants.

Original and quite different from ordinarily accepted methods, obtain here in the matter of piecing boiler tubes. They are spliced with a full section of the metal on both the flue and piece by enlarging the flue by driving in a mandrel to a depth equal to that for a scarf, and introducing the piece without any reduction at the end, and then welding. This certainly makes a very secure job, and on that account is regarded superior to either the butt or scarf weld. The reduction of area of tube opening at the weld was inappreciable in the tubes we inspected.

The character of feed water on some portions of this line, makes the subject of washing out facilities a question of liveliest import, and the greatest attention is therefore given to the location of cleaning holes, so as to be able to reach every place subject to a deposit of mud or scale. To do this, there are twenty-eight wash plugs in the firebox and front end, distributed over the crown at the boiler head and on the sides, and also around the water leg. In addition to these plugs there are two 6-inch cleaning holes in the bottom of the waist, one near the front flue sheet and one near the throat sheet. This very liberal display of holes wherewith to attack the scale-producing properties of water while yet in their plastic state, serves two purposes—one of them to clean, and the other to see when the job is satisfactorily done.

An Innocent Hold-up.

"If I ever wanted to kill a man, it was last night," said John Bunker, as he came into the roundhouse after an all-night run, and the boys were all anxious to know the cause of Bunker's bloodthirstyness.

"Somebody call you a horse-thief, John?" broke in one.

"Horse-thief, nothing! Wouldn't a minded that a bit; but I do hate to be held up on the hill as I was last night.

"You see, 'twas this way, boys. We had all we could haul up the hill, and the old '91' was breathing as though she was on her last legs. 'Twas a bad rail last night, you know.

"We had just rounded the first curve up by the cut, when I see a light swing across the track, and I had to shut her off.

"We stopped by the light, and I heard a voice which was the richest Milesian brogue I ever heard, say: 'Gude avnin', misther, cud yez be afther givin' me a loight? Shure, me poipes gone clane out, and divil a match has I in my clothes at all, at all.'

"Maybe I wasn't mad. Stopping the '91,' with all she could hold, to give a wild Irishman a light for his pipe! But the more I thought it over, the funnier it seemed, and so I gave him a light; but warned him never to stop a train again, unless there was danger ahead, or he'd get fired. The poor devil had just been hired as a track-walker, and didn't know it was any harder to start a train of 'loads' than to start a wheel-barrow. But if I could got him when I first stopped, I'm afraid he'd have been chief mourner at a funeral."

John Bunker swears this happened on the D., L. & W. R. R., near Scranton, during the war.

Ten-Wheeled Freight Engine—Chicago & Northwestern Railway.

The Schenectady Locomotive Works have just completed an order for fifteen ten-wheeled engines for freight service on the Chicago & Northwestern system and a very attractive appearance they will be seen to have by a reference to our half-tone engraving which represents the group.

A severing of old ties, so long held sacred by railroad companies, in which small wheels have been held as a necessary adjunct to freight service motive power, is again seen in the 63-inch wheels of these engines, which are available for passenger work when a pinch for power has to be bridged over. On the contrary, a return to the practice of the past is seen in the four-bar guide and central cross-head, a just tribute to a device that has always deserved the good name it has earned. The long, springy, bent eccentric-rod has no place on these machines, and for good reason, Supt. of Motive Power Quayle having investigated their inherent cussedness very thoroughly by exhaustive tests; in this connection the particulars of valve setting will be found of interest in the following description of the general features of construction:

Type of engine—ten-wheeled.

Fuel—bituminous coal.

Weight in working order—156,000 pounds.

Weight on drivers—118,000 pounds.

Wheel base, driving—14 feet, 10 inches.

Wheel base, rigid—14 feet, 10 inches.

Wheel base, total—25 feet, 10 inches.

Diameter of cylinders—19 inches.

Stroke of piston—26 inches.

Thickness of piston—5½ inches.

Diameter of piston rod—3¼ inches.

Kind of piston packing—Dunbar.

Kind of piston rod packing—Crysler.

Size of steam ports—16x1⅝ inches.

Size of exhaust ports—16x3 inches.

Thickness of bridges—1⅜ inches.

Kind of slide valves—Allen-American.

Greatest travel of valves—5½ inches.

Outside lap of valves—⅞ inch.

Inside lap of valves—line and line.

Lead of valves in full gear forward—1-16 inch negative. In full gear back—3-16 inch negative. Lead at 6-inch cut-off in forward motion—7-32 inch.

Kind of valve stem packing—Crysler.

Diameter of driving wheels outside of tires—63 inches.

Material of driving wheel centers—cast steel.

Tires held on by shrinkage.

Material in driving boxes—steeled cast iron.

Driving journals, diameter and length—8½x11½ inches.

Main crank pin journals, diameter and length—6½x5½ inches. Intermediate, 6½x5 inches.

Side rod journals, diameter and length—front and back—4½x6 inches.

Engine truck—4-wheel, swinging bolster.

Engine truck journals, diameter and length—6x10 inches.

Engine truck wheels, diameter—30 inches.

Engine truck wheels, kind—McKee-Fuller, steel tired spoke.

Boiler, type—extended wagon top.

Boiler, diameter at small ring—63 inches.

Boiler, pressure—190 pounds.

Material of barrel—carbon steel.

Thickness of plates—7-16, ½, ⅝, and 11-16 inch.

Horizontal seams—butt joint, sextuple riveted, with welt strips inside and outside.

Circumferential seams—double riveted.

Fire box, length—102 3-16 inches.

Fire box, width—40⅜ inches.

Fire box, depth—front, 79¾ inches; back, 67¼ inches.

Fire box material—carbon steel.

Fire box plates, thickness—sides and back, 5-16 inch; crown, ⅜ inch; tube sheet, ½ inch.

Fire box water spaces—front, 4½ to 5 inches under tubes; sides and back, 4 inches.

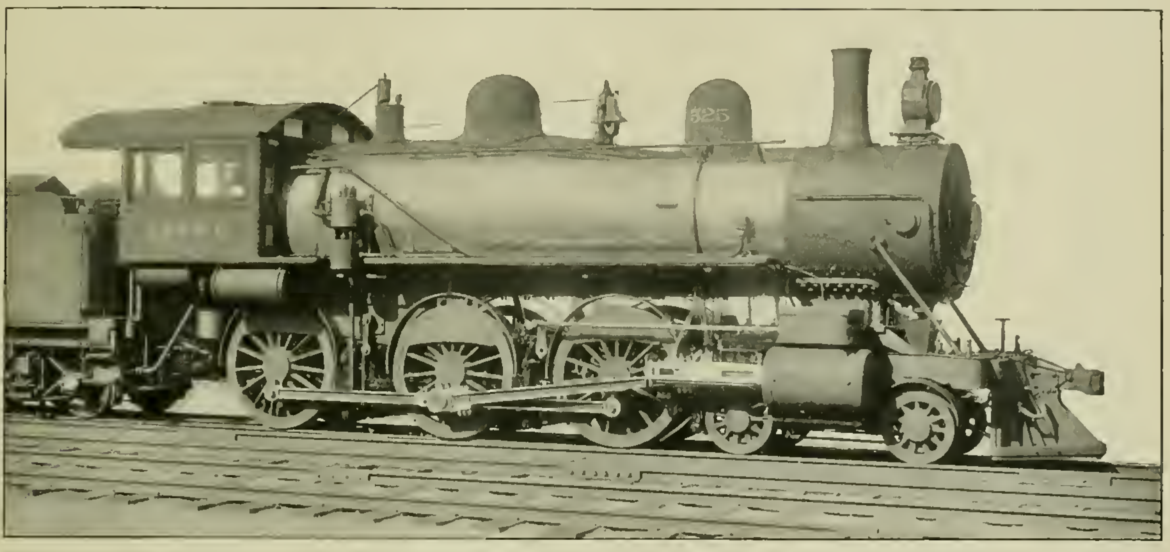
Fire box, crown staying—radial stays, 1 inch in diameter.

Fire box staybolts—⅞ inch diameter.

Tubes, material—charcoal iron 0.125 inch thick, Master Mechanics' decimal gage.

Tubes, number—295.

Tubes, diameter—2 inches.



SCHENECTADY TEN-WHEEL FREIGHT ENGINE FOR CHICAGO & NORTHWESTERN.

Tubes, length over tube sheets—14 feet, 2 inches.

Fire brick arch supported on water tubes.

Heating surface of tubes—2158.3 square feet.

Heating surface of fire box—152.6 square feet.

Heating surface, total—2310.9.

Grate surface—28.65 square feet.

Grate, type—rocking.

Exhaust pipe—single.

Exhaust nozzle, diameter—4¾, 5, and 5¼ inches.

Smoke stack, inside diameter—16½ inches at top, 14 inches near bottom.

Smoke stack, hight from rail—14 feet, 9 inches.

Injectors, two—Monitor No. 9, type "R" of 1897.

Tender, weight empty—39,670 pounds.

Tender wheels, number—eight.

Tender wheels, diameter—33 inches.

Tender journals, diameter and length—4½x8 inches.

Tender wheel base—15 feet, 0 inches.

Tender frame—10-inch steel channels.

Tender trucks—arch bars, center bearing, with channel transoms.

Water capacity—4500 U. S. gallons.

Coal capacity—eight (2000 lb.) tons.

Total wheel base of engine and tender 51 feet, 8¼ inches.

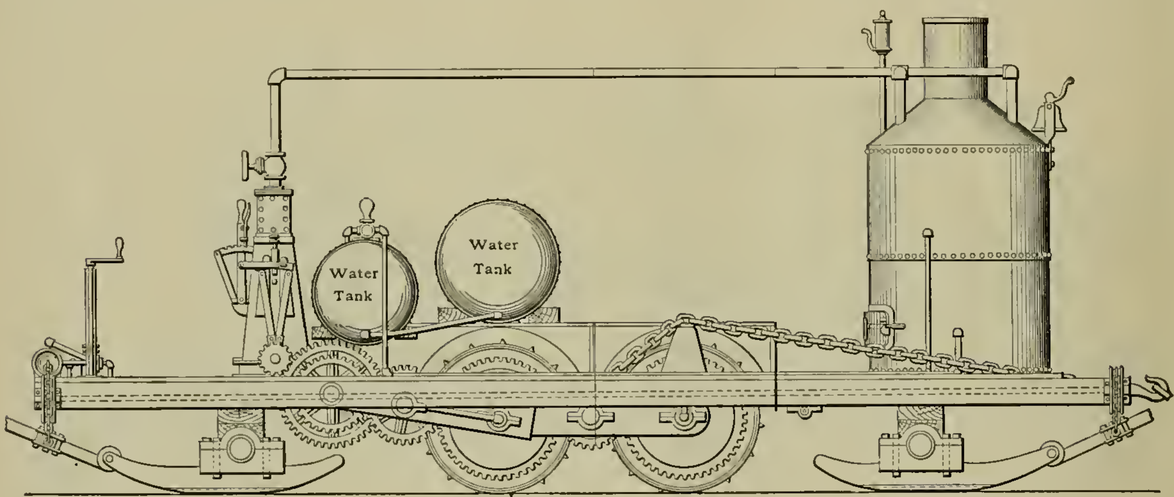
Total length of engine and tender—60 feet, 4⅜ inches.

Engine equipped with two 3-inch Ashton safety valves.

One McIntosh blow-off cock.

American brake on all drivers, operated by air. Westinghouse automatic air brake on tender and for train; 9½ inch air pump.

Dean's sand feeding apparatus. Chicago coupler on engine and tender. No. 3 Crosby chime whistle. Gollmar bell-ringer. Metallic brake beams.



KLONDIKE LOCOMOTIVE.

Snow Locomotives for the Klondike.

Some of the alleged mechanical papers are printing "stuff" about a hot-wheel snow locomotive which is to solve the problem of winter transportation to the Klondike and bring joy to the hearts (and stomachs) of the miners. The wonderful engine referred to is shown in the accompanying engraving—the "hot-wheel" feature not being apparent.

A small reversing engine furnishes what power survives the various transmissions through the gearing and drives the central wheels, whose numerous warts are to aid in driving the "locomotive"—save the mark! For crude design, both mechanically and from the steam-engineering standpoint, it is one of the worst specimens we have seen, the long steam pipes, even if lagged as well as possible, being sure to make it interesting for the engine with the thermometer 'way below freeze.

It is stated that Secretary Alger had them in use on his place in Michigan, for hauling logs through the forest; but reports from the firm and the builder, Mr. George T. Glover, of Chicago, Ill., do not agree as to the satisfaction given. It is said that these are being seriously considered as a means of winter transportation to the Klondike, but we cannot believe that such a device can find favor, if it is considered from a mechanical standpoint. The army or navy department, in which engineers are considered only as necessary evils, are liable to approve anything.

Deceived as to Speed.

'Twas on the Pennsylvania road, and the 8:20 from Philadelphia to New York, and one of our friends had for a seatmate a backwoods gentleman who evidently wasn't used to good roadbeds or easy riding cars.

They had got along about to Bristol, and the B. G. couldn't stand it any longer. His local pride got the best of him, and he burst out with:

"Huh! stranger, I tho't ther Pennsylva-ne-a road could make fast time—run er mile er minute, etcettery; but she don't be adoin' it to-day—do she, stranger?"

The dignified listener is an old traveler, and has been fooled himself about high speed, and before replying he pulled out his watch and one of LOCOMOTIVE ENGINEERING "Clubs are Trumps" cards and timed a mile, then referred to the card for speed in miles per hour.

"My friend," said the D. L., "how fast do you think we're running now?"

"Wal, stranger, on our road ter hum, I should say, by the way the car rides and the fact that yer don't have ter hold on ter yer seat, that we was runnin' not over 25 miles an hour. I ride on our road quite a little, stranger, and I can guess purty durn close, too."

"Well, time a mile here," said the D. L., and the B. G. timed. When the first mile-post shot by in just 60 seconds, he wasn't ready for it, and when the next one was reached in 59 seconds his eyes stuck out and he involuntarily gripped the arms of the seat.

"Stranger, are you er jokin me, or are we actually arunnin' a mile er minit. Gosh, there's another mile-post, sure's yer born! Wal, I tho't I knew when I was aridin' fast, but these yere cars ride so smooth and don't jerk yer round skeersly.

"Our road ter hum will jerk ther livin' out of a mule at 30 miles an hour, an' if yer don't hold on the seat at 35 miles, yer go thro' ther winder.

"Say, stranger, this is a great road, isn't it?

"What's that—there's others that ride about the same? Wal, if I don't roast ther manager of our road when I get back hum my name ain't Josiah Peppercorn, that's all."

If you think the B. G. was very green, try it yourself on different roads and roadbeds.

Keeley, the man of motors that never mote, of etheric influences that draw cash out of stockholders who must be "easy marks," of harmonic vibrations, etc., etc., has taken up a new game for the same purpose—i. e., drawing money out of somebody else. This time it's a flying machine which weighs two tons, but which, by Keeley's new scheme, "levitation," will set aside the law of gravitation and soar at will, despite its great weight. Keeley says he isn't after money for himself, but will start a large laboratory and workshop for the free use of poor inventors who are struggling to perfect new ideas. Keeley's twenty-five years' struggle has been a hard one—for the stockholders; but Keeley has made a good living at it.

How to Make Heavy Repairs on the Locomotive Boiler.

BY HENRY J. RAPS.

With proper care, the back sheet of firebox should last until the box is renewed, with possibly the exception of that part of sheet around fire-door opening. However, it sometimes happens that it has deteriorated to such an extent that its renewal is made necessary at the time the lower part of side sheets are renewed. Should it be necessary to remove the crown bars, a whole sheet should be put in, as the rivets in upper seam, and a part of those in vertical seams, may be held on from the inside of boiler. It will also be cheaper to put in a whole sheet than to cut the old one in two and make a new seam.

If the crown bars are not removed, the back sheet should be cut across 3 or 4 inches above the door hole. It will then be possible to hold on all the rivets from below, except a few in the middle of upper seam and three or four in the top of door hole.

Should crown-bar washers be small in diameter, the crown-bar rivets should last as long as the firebox, provided that proper attention has been paid to keeping the scale off from crown sheet.

If the crown-bar washers are of large diameter, the rivets will need renewing after eight or ten years of service. In spite of the best of care, scale will accumulate around the washers next to sheet, and become so hard that it is impossible to remove it with a cleaning rod. The result is—a space 1¾ inches to 2 inches in diameter is covered by the washer and scale from which the water is excluded, causing the rivet head to become fatigued or burnt out. A number of the heads will be found split from the edge from ¼ inch to ⅜ inch; they will also be sprung away from the sheet, at the edge, from 1-32 inch to 1-16 inch. If a chisel is inserted under the head, it may be broken in pieces without much effort. The quickest way to remove crown-bar rivets, that are badly fatigued, is to flatten the heads with a sledge and drive the rivets out of the holes with punch and hammer.

Should it be necessary, for any reason, to renew crown-bar rivets that are in good condition, it will be found advisable to drill them out, using an air motor to furnish the power. They should be drilled through the countersink and driven out with punch and hammer.

A very good washer to insert between crown bar and sheet is made of a piece of 1-inch pipe, and a flat washer of ¼-inch steel; the piece of pipe is put next to sheet, and the flat washer placed next to crown bar. These are cheaper, and far superior to the cast-iron washer commonly used, as they take up less room, thereby facilitating the cleaning of crown sheet. Old pipe and refuse plate may be used for the washers, entailing a nominal expense for material.

It occasionally happens that the renewal of crown sheet is made necessary before the firebox is renewed—usually on account of being mud-burnt. The most successful way to remove the crown sheet is to cut out all the rivets from the seams of crown, and the upper rivets in one of the side flanges of tube sheet as far down as the swell. Remove ten or twelve staybolts from the upper front corner of side sheet, on the same side of box; pull the corner of side sheet out with bolts, and the corner of the tube sheet in with a turn-buckle fastened to front tube sheet. The crown sheet can then be removed with very little trouble.

Should the tube sheet be renewed at this time, the crown bars may be left on sheet, and removed more quickly and with less trouble after sheet has been taken out. The crown-bar rivet holes should be punched in new sheet before it is flanged; after flanging, the corners should be shaped to fit the corners of tube and back sheets, respectively. The sheet is then annealed. The rivet holes in ends and flanges may be located by putting sheet in place and marking the holes with a scratch-awl, or they may be laid out by cutting a thin lath to the shape of end sheets and marking the location of holes upon it, then transferring them to crown sheet. The holes in side sheets may be marked on a stick and transferred to flanges. They are then punched or drilled; those in flanges countersunk; edge of flanges beveled in planer; sheet put in place, riveted, chipped and caulked. The crown bars are then put on and riveted, and braces replaced.

The lap on crown sheet should not be more than ⅞ inch from center of holes. The corners of sheet should be reduced, so that, after scarfing and flanging, they will not project beyond balance of flange; this will save considerable trouble when putting sheet in place.

After twelve to fifteen years of service, the whole of firebox will need renewing. The staybolt heads should be cut off and the bolts drilled in the thickness of outer sheets. The countersunk rivets in head and ring should also be drilled, as well as the ends of tie rods extending through wagon top, the rivets being then cut out of back head and bolts broken. If there is no staybolt breaker, they may be broken with a punch and hammer, or the ends may be cut out with a cape chisel. The braces are then loosened and head removed; the mud ring is then removed, and balance of staybolts broken. The bolts in sides (and crown, if boiler is radial stayed) may be broken with the ram illustrated in Fig. 1, if there is no staybolt breaker. Its weight should be from 180 to 200 pounds; it should be hung so that its center of gravity will be about 6 feet from back end of boiler. A gang of three men will be required to operate it successfully; one man to hold the bar in position, and two to operate the ram. The staybolts in tube sheet may be broken from inside of shell with bar and sledge. The braces are then taken off of crown bars, and box removed.

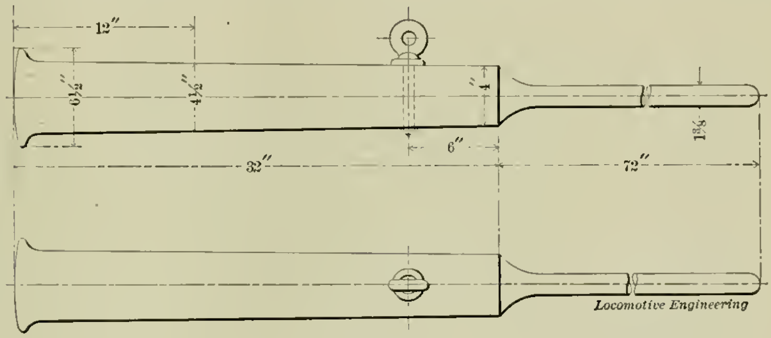


Fig. 1

STAYBOLT BREAKING RAM.

It is likely that by this time the corners of mud ring are badly cracked. If such is the case, new corners or new ends should be put in, and the sides straightened if necessary.

When laying out the rivet holes in new box, the holes in flange of back sheet should be located 2¼ inches from outside of sheet and 2⅜ inches in tube sheet, on the assumption that the edge of flange on back sheet is 3⅛ inches from outside of sheet and 3¼ inches on tube sheet; this leaves ⅞ inch from center of holes for lap.

Two patterns should be made the thickness of side sheet—one of them bent the shape of end sheets to lay out side flanges, the other left straight for laying out side sheets; a flexible strip of wood the thickness of side sheet will answer the same purpose. The upper hole in side flanges should be located 1¾ inches from top of sheet, and the upper seams in side sheets lined off from these points. Assuming that the edge of flange on crown sheet is 3⅛ inches from outside of sheet, and the sheet 3/8 inch thick, this will leave 1 inch from center of holes for lap.

In laying out the side sheets, we will take the length of mud ring on the inside; we will assume that it is 72 inches, and make the firebox 1/8 inch shorter, so that the mud ring may be inserted without much trouble. The holes in back sheet have been located 2 1/4 inches from outside of sheet, and those in tube sheet 2 3/8 inches. These added together equal 4 5/8 inches, plus 1/8 inch equals 4 3/4 inches. This deducted from 72 inches equals 67 1/4 inches, or the distance between the end seams, which are then laid out with the template previously made.

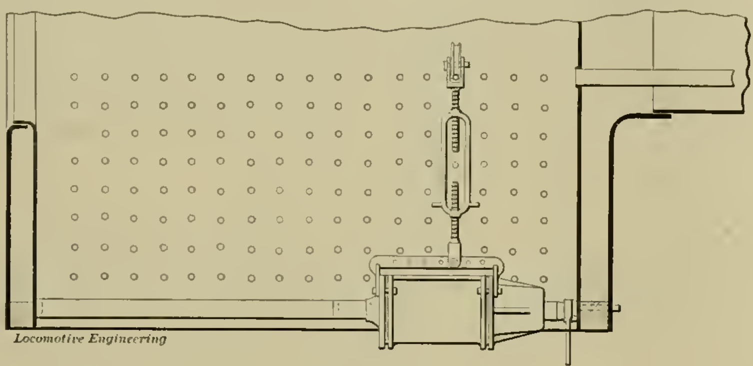


Fig. 2

PNEUMATIC "HOLDER-ON."

In laying out the rivet holes for mud ring, we will assume that the first hole is 1 3/4 inches from end of ring on the inside, which brings it 9-16 inch outside of back seam and 11-16 inch from front seam. The holes in ring may be located on a stick and transferred to sheet.

In laying out the staybolt holes, we will draw lines with a chalk line across the holes in lower part of outer side sheet in a vertical direction, extending the lines to bottom of sheet, locate the position of these lines relative to mud-ring holes upon a stick, and transfer to sheet.

To locate the position of staybolt holes on these lines, the shape of flange on back head should be drawn full size, also the shape of flange on back and tube sheets in the same relative position that they occupy when in place.

The shape of back head may be obtained by bending a piece of iron over the outer side sheet. The position of staybolt holes and mud-ring holes should be marked upon it. They may then be transferred to drawing, and lines produced from these points normal with contour of back head to meet the line which represents flange of back and tube sheets; these points may then be marked on a piece of hoop iron. Holding the hoop iron a distance equal to half the thickness of side sheet away from the line, these points are then transferred to first vertical row of staybolt holes in front and back of side sheet; lines are struck across the sheet with chalk line from these points, and the work of laying out the side sheet will be finished, except marking the shear line. This should be 7/8 inch from center of holes in the ends, and 1 inch on top will usually be sufficient to meet end of crown bar, and 1 1/8 inch to 1 1/4 inch on bottom, according to location of holes in ring. The sheets are then punched, bevel-sheared or planed; lower corners scarfed, then annealed, straightened, and bent in the rolls to fit back and tube sheets.

The two ends and sides are then bolted together, crown put in place, and holes marked. Holes are then punched, edges planed, or they may be bevel-sheared before flanging.

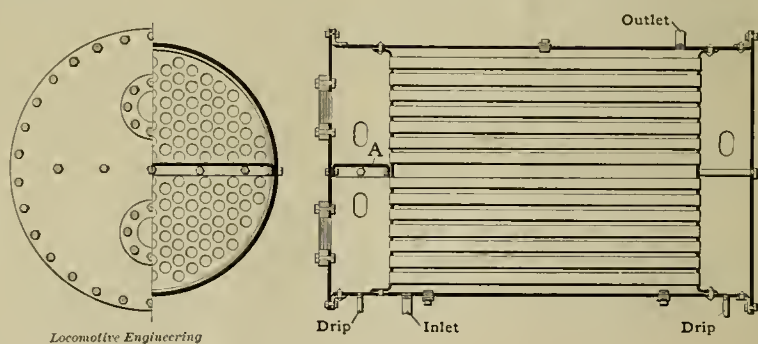


Fig. 3

CHANGING LOCOMOTIVE BOILER FOR FEED WATER HEATER.

The second rivet hole from ends in flanges should be countersunk on the inside, so that rivet may be driven flush to make room for caulking end sheets. The crown is then replaced, and box riveted and caulked. The crown bars are then put on and riveted. The firebox is then put in the boiler, lowering it as much as possible in order to hold on the rivets in upper part of back head conveniently. It should also be put forward as far as possible, so that the rivets in lower part of back head may be held on without trouble.

The back head is put in position and riveted, after which the firebox is put in place and door hole riveted. The mud ring is then inserted and riveted. The pneumatic "holder-on" shown in Fig. 2 will be found very convenient for holding on the mud-ring rivets. It is an 8-inch air-brake cylinder hung on a 3/4-inch pipe, through which a 5/8-inch rod has been inserted, the rod also being inserted through water space. When used on sides of box, it is hung on a bar of 1 1/4-inch round iron, which is put through fire-door opening and into one of the tube holes.

In operation a number of the holes are hammered up and reamed or drifted. When the rivet is inserted, the button or cup is applied to the head as shown. It is given a smart blow or two with piston rod of holder-on; the rivet upset and snapped. The holder-on should be made the proper length for sides of box, and an extension used for ends, as shown. Compressed air is the power used, which is admitted and exhausted through a three-way cock.

After the mud ring has been riveted, the braces are put on tube sheet and riveted; plugs put in outer corners of the ring; staybolt holes tapped, bolts put in, cut off and hammered over; tie-rods and braces replaced, or renewed where necessary.

Should the bottom of shell be dangerously grooved at seams, patches should be put on outside. If there is considerable internal pitting, a liner may be put on bottom of shell. It will probably need to to be from 24 to 30 inches in width.

The bottom of front tube sheet will likely be cracked by this time along the bend. If it is at all dangerous, it should be patched on the outside; the patches should be riveted. It is very probable that the throat sheet will also need a patch or two—cracks usually developing just below the wing. If there is an old sheet about, the patches may be fitted over it before they are put in place.

Should cracks be developing in the back head in the bend of flange, they may be patched on the inside. The holes should be countersunk, and rivets driven flush. A patch may also be necessary across the bottom of head, on account of grooving along the top of mud ring. It is very seldom that the back head needs to be renewed, or rather, is renewed, for when the boiler has arrived at this stage in its decline, the expense of the necessary repairs is so great that it is unprofitable to make them. Should the head be renewed, the new sheet may be flanged over the old one (if there is no flange block to fit), and the flange set in the necessary amount afterward. All staybolt holes, brace and mud-ring rivet holes should be punched before flanging.

If the dome has been properly constructed, it should last as long as the part of boiler it is connected to without repairs. Neither should the throat sheet need renewing; it will likely be necessary at some time to put a patch on either side below the wing, and a patch across the bottom from 10 to 12 inches wide. With proper care in keeping tubes from filling up with scale at the front tube sheet, it should last as long as the shell.

By the time it is necessary to renew the firebox the second time, the boiler will have had the following repairs: One firebox, two or three pairs of half side sheets, two back tube sheets, the back sheet of box renewed twice (either entirely or partially), possibly one crown sheet, crown bars removed twice, a number of bolts in lower part of box renewed twice, a number of broken braces and staybolts renewed, the tubes reset six to eight times, the bottom of shell lined inside, a patch on the bottom of one or two of the girth seams, a new bottom in front course of shell, a new bottom in smoke arch, a patch on bottom of front tube sheet, three patches on throat and one or two on back head. These repairs, with probably an occasional patch on firebox and outer side sheets, will usually be sufficient to carry the boiler through to its twentieth or twenty-fifth year, and the expense of the necessary repairs to put the boiler in a serviceable condition is so great that the boiler is taken out of service.

If the boiler is still in good condition for low pressure, it may be utilized as a stationary boiler; tube sheets should be renewed and tubes of a large diameter put in. It may also be advisable to cut down the water leg, especially if the hight of door hole makes firing inconvenient.

Should the boiler be "scrapped," it is possible that a portion of the shell is still in a fair condition, and may be used for a feed water heater, as shown in Fig. 3. A hoop of 2½-inch angle is riveted to end of shell, and outer heads bolted to it, as shown. The partition *A* is surrounded by strips of pine, which, when they become swelled by the condensed water, make a steam-tight joint.

Should the heater be placed in a horizontal position, the partition should be placed as shown, so that the condensed water may run off through the tubes into opposite chamber, and thence into drip pipe.

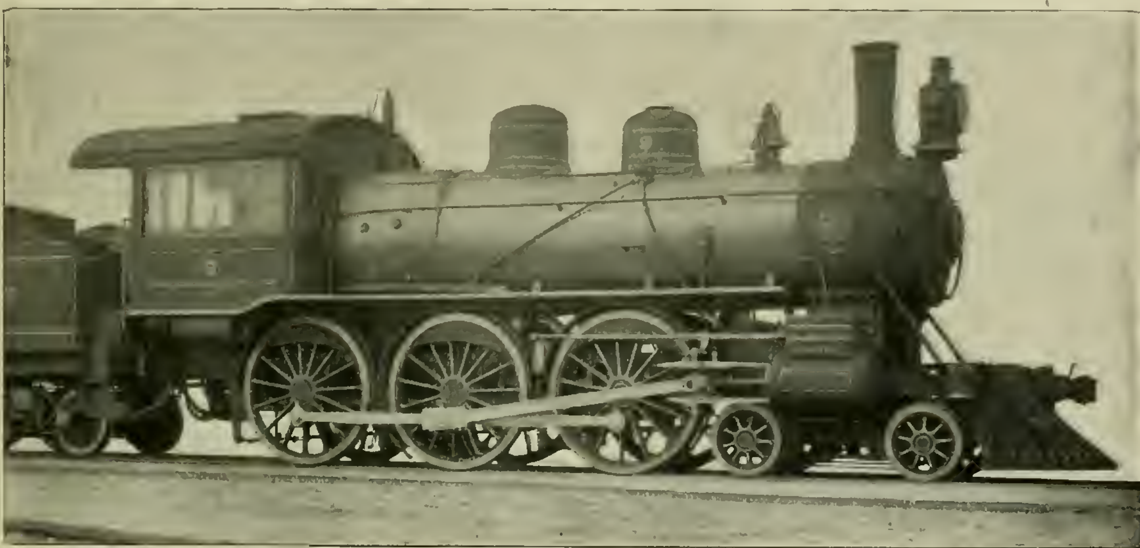
The outlet and inlet water pipes should be removed as far as possible from one another, to create all the circulation possible. The heater should be provided with wash-out holes, blow-off cock and safety valve.

The shell of the old boiler may also be used for a compressed-air reservoir by putting a head in either end. These should be braced by running rods through the drum, putting nuts on the outside. Pieces of pipe should be put on the rods between the heads; old tubes will answer the purpose.

It is impossible to lay down a hard and fast rule to determine the life of a boiler; a safe plan to follow is to "scrap" the boiler when it has deteriorated to such an extent that it is unfit to carry the pressure desired.

If the boiler is cut up and the courses of shell and wagon top straightened out, it will be interesting, if not surprising, to notice the condition of the plates. A number of cracks will be opened up to view next to rivet holes, from ½ inch to 1 inch long; some of them running across from one hole to another. It will be impossible to detect these until plates are straightened out; yet they are there, and slowly but surely they would have grown worse, and possibly have led to an explosion.

The natural consequence of keeping a boiler in service after it is about worn out is, that at some time it will throw itself away in a very decided and unpleasant manner.



BROOKS PASSENGER TEN-WHEELER FOR BUFFALO, ROCHESTER & PITTSBURGH.

Ten-Wheeled Passenger Engine—Buffalo, Rochester & Pittsburgh Railway.

The Brooks Locomotive Works have recently built an 18 x 24 ten-wheeler for the above road, and, as delineated in our engraving, appear well to the front in all points recognized as up-to-date practice in construction of the type of which the picture stands as an exemplar. A very familiar and prominent feature in latter-day boiler design, namely, the extension front, is noticeable by its absence on these engines. The fad of large extensions had a good long innings, and it will doubtless get a rest suitable to its needs, if present indications count for much—they all point to a reduction in length of smoke arches.

In the short eccentric rods is seen another return to rational methods for six-wheel connected engines. It will be conceded by everyone, we think, who has used the bent eccentric rod, that it is far better to bear the few ills of the short rod, than to fly to the evils of the flimsy bent one. The increased lead due to the short rod can be modified, but the springiness of the long rod cannot be overcome, and since its effect on steam distribution is coming to be well understood, the reason for the passing of bent eccentric rods is apparent. The long valve rods accompanying the short eccentric rods are carried through a guide which is secured to the guide yoke, and have a knuckle joint to prevent undue wear from the vibrations of the rocker. These particulars are mentioned for the purpose of showing the care taken to transmit motion from the eccentrics to the valve, that shall be entirely free from distortion, as far as possible to make it so by rigidity of connections.

Every wheel on the engine and tender has a brake shoe. Drivers have sand pipe at front and main wheels. The tender has the raised platform, bringing the coal deck on line with the bottom of cab, a construction peculiar to the later Brooks engines. The specification from which the engine was built is given herewith:

Type of engine—Ten-wheeled passenger.

Simple or compound—Simple.

Fuel—Bituminous coal.

Weight in working order—125,000 pounds.

Cylinders, diameter and stroke—18 x 24 inches.

Slide valves, kind—Richardson.

Driving wheel, diameter outside of tires—68 inches.

Driving wheel centers—Cast steel.

Driving wheel tires—Open hearth steel.

Engine truck wheels, kind—Cast steel, spoked, with steel tires.

Engine truck wheels, diameter—30 inches.

Boiler—Player improved Belpaire.

Wagon top—Steel.

Boiler diameter at smallest ring—57 inches.

Boiler pressure—180 pounds.

Boiler covering—Johns sectional asbestos.

Firebox—Long, sloping.

Firebox, material—Firebox steel.

Firebox, length—96 3-16 inches.

Firebox, width—32½ inches.

Firebox, depth front and back—71½ and 55½ inches.

Tubes, number—225.

Tubes, diameter outside—2 inches.

Tubes, length—13 feet 4 inches, No. 12 B. W. G.

Heating surface of tubes—1,563 square feet.

Heating surface of firebox—122 square feet.

Heating surface, total—1,685 square feet.

Grate surface—21.2 square feet.

Tender wheels, number—Eight.

Tender wheels, diameter—33 inches; steel tired.

Tender frame, style and material—10-inch channel steel.

Water capacity of tender—4,000 gallons.

Coal capacity of tender—9 tons.

Metallic packing—Jerome.

Bearings—Brass.

Brakes—Westinghouse American.

Brake beams—National, hollow.

Train signal—Westinghouse.

Safety valves—Two 3-inch Kinkle.

Lubricators—No. 9 Nathan, oval.

Injectors—Two No. 8 Monitor.

Steam gage—6¾-inch Ashcroft.

Springs—French Company.

Headlight—18-inch, round case.

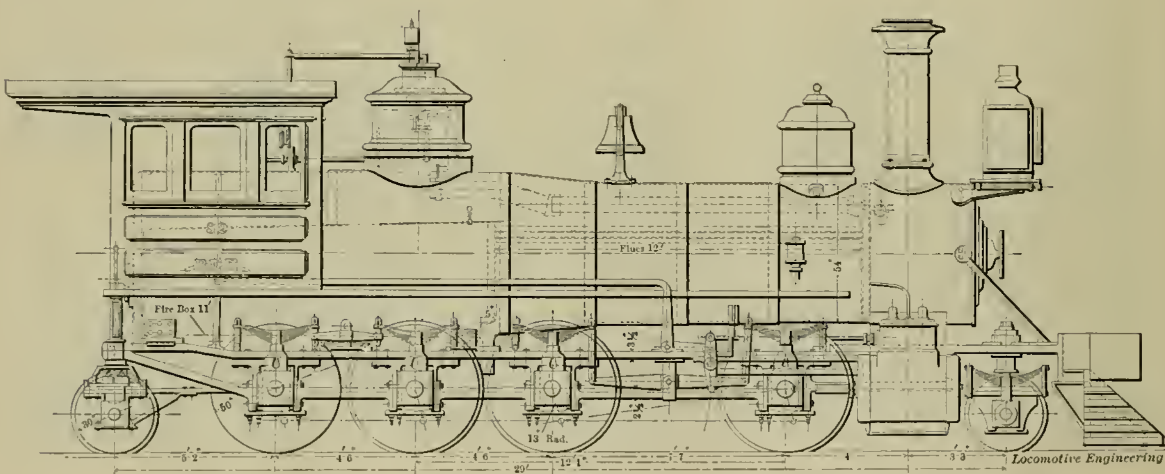
The engine is equipped, in the way of special devices and materials, with: Martin steam heat, Trojan couplers, Cooke bellringer, Leach double sander, cylinder heads and steam-chest casings of pressed steel, smoke-box front and door of pressed steel, driving boxes and back cylinder heads of cast steel.

The First Decapod.

One of our correspondents, Mr. M. F. Jukes, of Whatcom, Washington, sends us a communication regarding the decapod shown in the chart which appeared in June. He also sends us the accompanying outline of the engine, and wants to know whether the engine was originally a decapod or of the style shown in the outline. Inquiry of Mr. A. Mitchell, of the Lehigh Valley Railroad, who had the engine built at Lancaster, Pa., in 1867, resulted in the information that the Ant and Bee were both decapods originally, but were changed in 1883 or 1884 to the form shown in the sketch.

It has been suggested by a somewhat sarcastic corresponaent that the trailing wheels were substituted for the rear drivers, to make the engine pull more cars up the Sugar Notch Hill. Needless to say, this was not the reason, although it is difficult to see the advantage of the trailers, for after a little experimenting, they were removed, and the engine has since been run quite successfully without either drivers or trailers under the back end.

When first built the main rod was connected to the third pair of wheels, as shown in the June chart. The cylinders were 20 by 26 inches, drivers 50 inches in diameter.

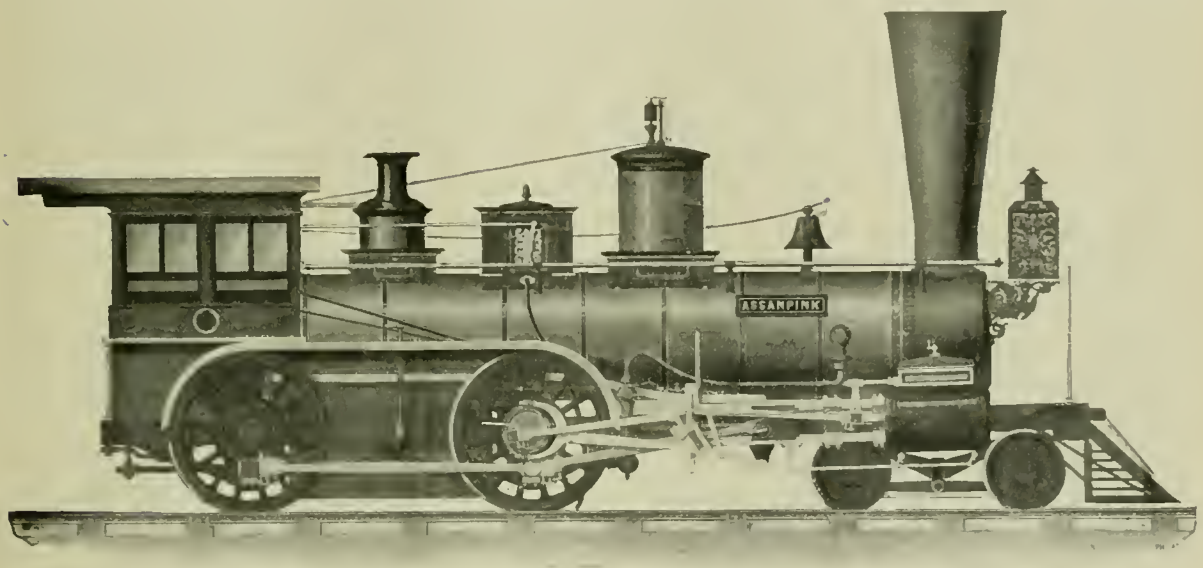


FIRST DECAPOD.

Old Trenton Locomotive.

The old locomotive shown in the accompanying engraving was the product of the old Trenton Locomotive Works in about 1855. The name "Assanpink" was taken from a little stream running through Trenton and emptying into the Delaware River.

It was used on the Belvidere & Delaware Railroad, or the "Bel. Del.," as it is familiarly called by the boys. The engine had cylinders about 16 x 24 inches and 5-foot drivers. The valve motion is the stationary link and shifting block type, as will be seen, and has the advantage of being easily get-at-able, whatever its disadvantage may be. The general appearance is similar to many of the old-timers, the gun-barrel boiler, the generous dome and stack, and the fancy work on the headlight being typical of early locomotive building.



OLD TRENTON LOCOMOTIVE.

We are indebted to the kindness of Mr. A. Mitchell, superintendent of the Lehigh Valley Railroad, at Wilkesbarre, Pa., for the picture and the data in reference to it.

Cy Warman Says the Romance of the Rail Is Coming.

At a convention of railroad brotherhoods held at Buffalo lately, Mr. Cy Warman said:

"The great critics of the country who, for pay or pastime, read books and then make remarks about them, kind and unkind, are becoming interested in the railroad. They are expressing surprise that so swift an institution as the American railway should have been so slow to influence American literature. They are amazed that the book builders could allow so fertile a field to lie fallow for so long a time. They are also surprised, and agreeably so, that the comparatively few tales of the rail that have reached the public through enterprising publishers, are of more than ordinary interest.

"In view of the fact that, with the possible exception of Mr. Kipling, none of the great story writers has touched the railroad at its most interesting point. This is encouraging and gives reason for the prediction that we may have some thrilling romances of the rail by the time we begin to write 1900 at the top of our letters.

"We have had miles of manuscript upon the miner, the cowboy and the soldier; but the true story of the railroad and of the railroad men is yet to be written. The main reason why it was not written long ago is that the story writer is unacquainted with the real railroader. To be sure, we have had glimpses of the anxious investor, the stock jobber, the careful, watchful manager, and even pictures of the daring locating engineer, who crosses the desert and climbs into the crags of the Rocky West; but when I speak here of the railroader, I mean, first of all, the locomotive engineer, who goes up against the darkness without the inspiration of a brass band, and the fireman who keeps the engine hot, and sometimes the engineer as well. I mean the conductor and his companions, who skate over the icy tops of box cars; the express messenger and mail agent and the switchman, switching in the yard.

"You cannot forget the switchman. He won't let you. If you pass at night through Sacramento, Pueblo or Buffalo, he cuts off your car and breaks a two-dollar night's rest for you. Broadly speaking, railway employés include the sectionman and the manager and all who walk between; but the trainmen and enginemen, who day and night go whistling up and down the world, making time, history and noise, are the men who will influence the literature of the railroad. And this literature, I opine, will be distinctly American. It will not be English, except in language."

A suit was recently decided by the Supreme Court of Arkansas, which is of direct interest to all locomotive engineers. The Brotherhood of Locomotive Engineers on a leading Arkansas railroad has a contract with the company by which seniority of service gives priority of right of employment, so that when slack of business demands that one or more engineers be laid off, the last engineer on the list shall be the first reduced. One of the senior engineers having been set back, he brought suit against the company on the grounds that he was discharged without a cause, and in violation of his contract of employment. It was conceded that his contract gave him the right to quit at pleasure, and the court denied his right to recover, on the grounds that no contract can be valid that gives one party thereto the right to terminate it. The court held that the right to rescind or terminate a contract must be mutual.

A Philadelphia paper, describing one of the class "L" locomotives recently built at the Juniata shops of the Pennsylvania Railroad Company, says: "A novel feature of the new locomotive is the combination of steam dome and sand-box, from which good results are anticipated. The sand is let down on the rail by an air valve, instead of the lever, as in the older types of locomotives."

The Diamond "S" Brake-Shoe Tests.

In our November (1897) issue, page 850, we described and illustrated the Diamond "S" shoe, calling attention to some specially commendable features of the device, among which were the frictional holding power and wearing qualities as seen in service.

These shoes have recently been subjected to a very exhaustive series of scientific laboratory tests at Wilmerding, Pa., the records of which are of the greatest value. The shoes were tested on a machine of the Emory dynamometer type, which is easily adapted to a test of this character, the shoe being held to contact on the face of the wheel by means of a loaded lever on which known weights were placed.

Emergency pressures prevailed in all of the tests, and were maintained until the end. The coefficients of friction shown by the soft and hard shoes, Nos. 2 and 6 give somewhat more friction for the soft shoe, as shown at the speed of 65 miles an hour, and also in all the tests at 40 miles an hour; but a comparison of the hard shoe No. 6 with the plain hard cast-iron shoe No. 7 for all tests, the "S" pattern, that is the inserted steel, gives a higher mean coefficient of friction, both on the cast and steel-tired wheel tests. In the light of these tests, the claim of equal friction with a plain cast shoe, with four times the wearing life of the latter is borne out by facts. Appended table shows results in averages for steel and cast wheels:

TABLE OF AVERAGE RESULTS—No. 1.

TESTS OF 13-INCH BRAKE SHOES ON STEEL TIRED WHEEL.

No. of Tests in each Average.	Shoe No.	Pressure on Shoe, Lbs.	Initial Speed in Miles Per Hour	Travel of Wheel in Feet.	Mean Pull on Shoe, Lbs.	Mean C. of F. Per Cent.	C. of F. near Beginning. Per Cent.	C. of F. 15 ft. from End, Per Cent.
3	No. 2.*	10,733	65.19	1330.2	1250.2	11.65	13.15	20.04
5	"	6,750	65.37	1666.1	920.6	13.63	16.50	23.07
3	"	6,750	40.46	437.8	1366.6	20.25	23.08	27.61
7	"	2,798	65.22	3226.0	449.9	16.08	19.34	31.19
3	"	2,798	40.46	758.3	711.1	25.41	26.66	34.10
3	No. 4.*	6,750	40.46	504.4	1218.9	18.06	17.22	26.99
4	"	2,798	40.80	913.9	655.7	23.43	21.38	35.62
3	No. 6.*	10,733	65.64	1863.1	804 3	7.49	8.11	15.51
3	"	6,750	65.19	1728.5	866.3	12.83	12.96	22.77
3	"	6,750	40.91	597.4	892.7	13.23	12.96	22.06
3	"	2,798	65.19	2754.6	468.9	16.76	16.25	30.26
3	"	2,798	40.46	965.9	481.5	17 21	15.01	29.26
4	No. 7.*	6,750	40.46	665.8	827.1	12.14	10.56	22.55
3	"	2,798	40.61	1076.8	440.9	15.76	13.89	30.38

TABLE OF AVERAGE RESULTS—No. 2.

TESTS OF 13-INCH BRAKE SHOES ON CHILLED WHEEL.

No. of Tests in each Average.	Shoe No.	Pressure on Shoe, Lbs.	Initial Speed in Miles per Hour.	Travel of Wheel in Feet.	Mean Pull on Shoe, Lbs	Mean C. of F Per Cent.	C. of F. near Beginning. Per Cent.	C. of F. 15 ft. from End. Per Cent.
3	No. 2.*	10,733	65.04	1294.1	1336.3	12.44	11.99	22.63
3	"	6.750	65.19	1543.3	1086.3	16.09	17.33	28.68
3	"	6,750	40.76	441.0	1408.6	20.87	23.08	30.17
3	"	2,798	65.64	2964.8	504.6	18.03	23.07	36.95
3	"	2.798	40.76	871.3	673.7	24.08	27.28	33.24
3	No. 4.*	6.750	41.06	409.9	1560.7	23.12	25.34	31.77
3	"	2,798	41.06	880.1	700.4	25.04	21.70	39.69
3	No. 6.*	10,733	65.19	1527.5	1057.9	9.95	9.30	19.82
4	"	6,750	65.19	1749.7	930.2	13.67	12.88	25.41
3	"	6,750	40.61	490.4	1196.2	17.73	17.53	28.74
3	"	2,798	65.49	2914.3	481.6	17.21	18.97	34.72
3	"	2,798	40.61	898.1	606.9	21.69	21.83	34.84
3	No. 7.*	6,750	40.76	644.3	930.5	13.78	13.16	26.79
6	"	2,798	40.76	1211.4	462.3	16.52	15.07	30.02

* NOTE.—No. 2, D.amond "S," soft; No. 4, plain soft; No. 6, Diamond "S," hard; No. 7, plain hard.

DIAMOND "S" BRAKE SHOE TESTS.

A Long Man Sleeping in a Day Car.

Sleeping in a day car is far from being a comfortable experience for a person of ordinary stature, but the disagreeable features of a night passed in that way are greatly aggravated for a man of unusually large dimensions. A few years ago, when steam-heated cars were not so common as they are to-day, a six-foot-and-a-half lumberman walked into a sleeper on a West-bound train at Port Jervis, handed the African his bag and a $2 bill, and exclaimed: "Porter, stow away my bag, and see that you don't break the bottle on the top. Hurry up a berth for me, for I am tired and sleepy."

The big man was much disgusted to find all the berths taken. He goes into the day car, and prepares to make himself as comfortable as circumstances will permit. Takes off his boots and rests his feet on his bag, to keep them off the floor. After a brief trial, finds his knees in the way, and slides them up to the top of the seat in front. Body and legs now form an inverted "N," and he falls asleep. When the conductor rouses him half an hour later to ask for his ticket, he imagines that his neck is broken; but it has only got the cramp. He decides to try another plan, so he takes his bag to use as a pillow. As he lays his cheek upon it, he finds that the bag has picked from the floor an abandoned chew. He says "—— —— —— ——" two or three times, and then he takes out his knife and scrapes off the tobacco. After that he lies down and stretches his legs over into the aisle. "Comfort at last," he grunts, and has just fallen asleep, when a man comes along to take a drink, and calls upon him to take his legs out of the passage. He holds them in a perpendicular position, like the draw of a raising draw-bridge, until the man gets through, going and returning. Again he goes to sleep, and is hardly begun to snore, when another passenger demands the right of way to the water cooler. By the time that eleven others have taken their turn and the train men have claimed the right of way seven times, he decides that it is better to sit up.

After a time he prevails upon a brakeman to turn the back of the seat next to his, which was empty. Taking his bag for a pillow, he curls himself up into an irregular "U," and occupies both seats. He is now comfortable, and dreams that he is visiting Florida; but presently the scenes change to the Arctic region, and he imagines himself searching for the North Pole. On awakening with a start, he finds that the passenger who went out at Corning had forgotten to close the door, and a zero wind is blowing in at forty miles an hour. He blesses the careless passenger as lumbermen bless, decides to warm up with a drink, but finds that his bottle has got broken, and he remarks again, "—— —— ——," and walks in the aisle to renew his circulation. By the time he reaches Buffalo he has made up his mind to adopt the practice of engaging a sleeper a month ahead, or of staying at home.

❦ ❦ ❦

The "moon" theory about the bad effect of the sunlight and moonlight on edge tools is again traveling the rounds of the so-called technical press, and people are warned against purchasing tools which are displayed in show windows. This theory probably originated in the mind of some hardware man who was too lazy to make any display in his window.

The Latest Tabor Molding Machine.

So many of the brass and iron castings used in railroad work can be molded with the best results by machines, that we present the following illustrations and description of the most efficient molding machine, as well as the most modern, in the market to-day. The Tabor machine is, however, no stranger to railroad shops, some fifteen of these machines using stripping plates being in successful use in these shops, and many others in shops doing railroad work.

Ever since molding machines using stripping plates were first adopted, the high cost of patterns and plates has been an obstacle to their adoption.

It is the avoidance of costly stripping plates which makes this machine especially noteworthy. Ordinary split patterns of either wood or metal are cheaply applied to flat plates in this machine, six sets of four to eight pieces of split patterns having been fitted to plates by one man in a single day.

Fig. 1 shows the machine ready to receive the flask, the patterns being up, ready for molding. Fig. 2 shows the machine after the patterns have been drawn and flask lifted off.

Briefly, the operation of the machine is as follows: The ramming head shown thrown back at the top of the machine is drawn forward into a vertical position, after flask has been placed and filled with sand. The three-way cock shown at the the extreme right is then quickly opened, admitting compressed air at 70 to 80 pounds pressure to the inverted cylinder shown at the center of the cut. The cylinder, with the entire upper portion of the machine, is thus driven forcibly up against the ramming head flask, sand and all.

Gravity returns the machine to its first position, when the three-way cock throws to exhaust. After pushing ramming head back and striking off or cutting sprue, the operator seizes the lever shown just inside the three-way cock at the right, and, drawing it forward and down, raises the outer frame of the machine with flask and sand thereon, away from the patterns, thus drawing them from the sand. When he seizes the lever with his right hand, he presses with his left on the head of a compression valve, shown at the left side of top of machine, thus admitting compressed air to a pneumatic vibrating device consisting simply of a reciprocating plunger, which is its own valve, estimated to make about 5,000 strokes per minute on hardened anvils at either end. This vibrator is attached rigidly to a frame, to which pattern plates are screwed and dowelled, the jar of which is insulated from the rest of the machine by elastic bushings surrounding the bolts which secure it to its place.

By this vibrator the patterns are so agitated while leaving the sand that, while the molds they leave are exactly pattern-size, yet they draw more perfectly than is accomplished by any other method. The machine is manufactured by the Tabor Manufacturing Company, Elizabeth, N. J.

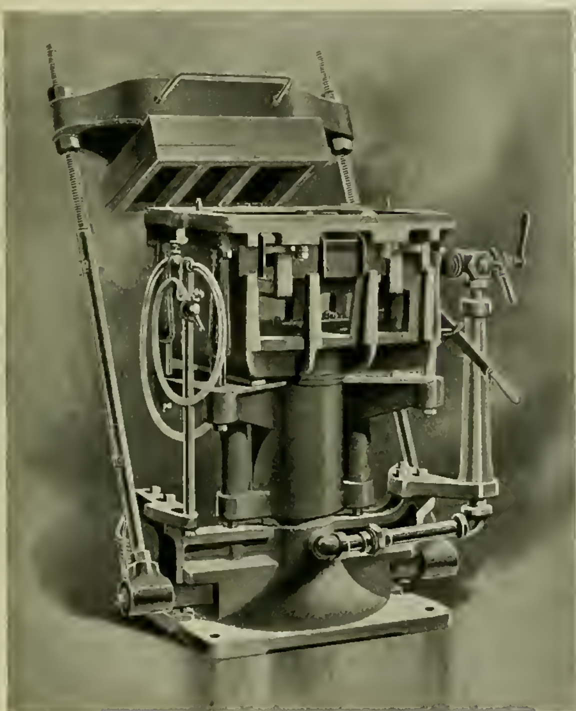


Fig. 1.

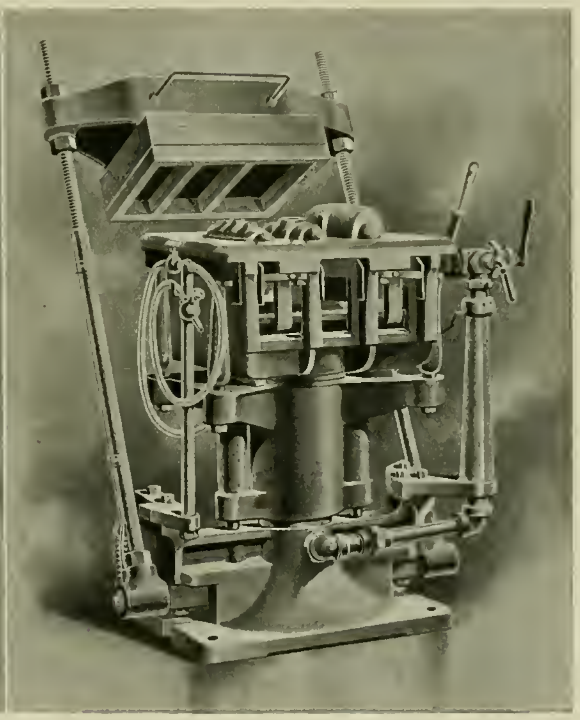


Fig. 2.

LATEST TABOR MOLDING MACHINE.

Asbestos.

The French manufacturers of asbestos goods are supplied from four sources: 1. Canada, whence the asbestos is white, silky, very unctuous, having supple fibers from 5 to 25 millimeters in length; of all varieties it is that which spins the most easily. 2. Siberia, whence the mineral is yellowish, some species being of a straw yellow. The fiber is less flexible and more woody, but stronger than the Canadian, which it resembles in length; large masses of long-fiber mineral being, however, rarer. 3. The Cape of Good Hope asbestos has a characteristic blue color. It occurs in larger masses than either the Canadian or Russian, and its fiber is generally longer and stronger. In spinning or other manipulation, however, it is difficult to handle, a good deal of the fiber being reduced to powder. 4. In Italy there are different kinds of asbestos, but generally they are little adapted to spinning. There are some long, silky fibers of little resistance, employed for gas furnaces; others are very short and fit only to make heat-retaining coverings.

The explosion of a locomotive boiler on the Erie Railroad last month gave rise to some very peculiar views as to the cause of the accident. One so-called expert expressed the opinion that it resulted from gas escaping from the firebox into the boiler, and another believed that it was possible the staybolts which held the firebox in place worked out, letting the firebox drop out of place.

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What Makes the American Locomotive Faster Than Those of English Design.

After months of hysterical screaming that the running reported as having been made by the Atlantic Railroad fast train during last summer was absurd, and engineering impossibilities, the London *Engineer* has at last been forced to admit that the "impossible" speed was accomplished. The painful admission is now made that an American express locomotive can run faster than an English express engine of similar proportions, and the whole editorial staff and correspondents of the paper named are racking the inside of their skulls to find out the cause of the difference. The only theory thus far advanced is a very lame one, and is to the effect that owing to peculiarities and rigidity of structure, the English locomotive progresses with a sinuous motion, the wheel flanges rubbing first on one line of rails and then on the other, a large proportion of the power developed being wasted in overcoming the flange resistance.

As cut and worn flanges are less common on the British railway rolling stock than they are on our cars and locomotives, the sinuous motion theory will not hold water. We advise the men who are working on this stupendous problem to secure detail drawings of an American express locomotive and compare the dimensions of all the important parts.

We have frequently heard the expression made use of by our ablest master mechanics and steam engineers, that there is no difficulty in getting all the steam necessary into the cylinders of a high speed locomotive, the difficulty is in getting it out quickly enough to prevent the pistons encountering the obstructive back pressure. If the back pressure is excessive at the higher piston speeds the engine will work against itself, so to speak, and a governor-like action will intervene which limits the rotation velocity. We do not think, on the whole, that large steam ports and their corollary large exhaust ports are conducive to economical use of steam, but there is no doubt that large passages for letting the steam out of the cylinders help very much in making an engine run freely. Our English friends argue that as American locomotives have smaller nozzles than those used in Great Britain, the obstruction to the free emission of the steam must be greater, but they forget that the large volume of space between the exhaust opening and the nozzle performs the part of a reservoir which holds the steam until it can be pressed through the nozzle. Those who have listened to the exhaust of high speed British locomotives must have been struck with the fact that the individual exhausts are much more distinct than they are with an American locomotive working with the same piston speed. The cause of this, no doubt, is that the exhaust pipe reservoir of an American engine tends to cause a continuous exhaust, while the British engine, with its limited exhaust pipe capacity, must jerk out the whole volume of exhaust steam the instant the exhaust port opens.

All the indicated diagrams which we have examined of British and American locomotives taken at high speed corroborate this statement. While we think that the features which make the American locomotive the fleetest in the world lead to much waste of fuel, careful investigation will show that our immense exhaust port is the only thing that causes the difference.

Fads Favoring Cheapness.

The hard times which the country has passed through in the last five years have made most people retrench on their expenses as much as possible. Individuals have been forced to get along with smaller incomes than they had before, and they have adjusted their expenditures to suit. Most of them have met their changed conditions modestly, and have not shouted from the house tops that they are indulging in petty economies that show self-denial, but do not furnish edifying details to brag about.

The men managing the business of corporations, especially that of railroad companies, have been less modest than the individual. They have tortured their ingenuity to find petty, mean things to save a few cents on, and then have boasted their achievements, so the echo of their self-adulation has resounded from State to State. This has brought on an epidemic of economy-shouting, till men with better sense are carried along with the movement, and under its inspiration do things that they would be ashamed to advocate for their private affairs.

One of the worst cases of this kind that we have witnessed since the epidemic began, is represented by a paper on "Fads, Customs and Their Cost," prepared by Mr. R. P. C. Sanderson for the New York Railroad Club. Mr. Sanderson can always be depended upon to say or write something striking, but he has outdone himself in the paper referred to. He confesses that the object of the paper is, to show that it is worth while to be mean and stingy where the efficiency is not impaired thereby. Then he proceeds to condemn the use of every ornate or attractive article on car or locomotive which might be replaced by something cheaper. The use of wrought-iron washers for car trucks, when cast-iron ones would do as well, is condemned, and ornate smokestacks are assailed as expensive abominations. The combustion chamber is scorched and semi-elliptic springs under locomotives condemned as a useless waste of steel and money. He would use coil springs that do not cost one-tenth of the price of elliptic springs. Probably the author of the paper would find it easier to recommend the use of hard riding springs than it would be to put them into daily use. The spirit of the whole paper is to the effect that the personnel connected with the operating of cars and locomotives are deserving of no more consideration than if they were made of his favorite material—cast iron.

Should the sentiments expressed in the paper become dominant in railroad management, headlights would be reduced to half their size, gold-leafed lettering of all kinds would disappear, brass oil cups would become a thing of the past, malleable-iron handles would be put on gage cocks, valves, etc., instead of wood or fibre composition, all ornamentation of cars would be abolished, and the insides would return to the severe simplicity of unadorned walls and plain wooden floors. There are numerous other changes advocated in the interests of the puritan-like ideas of economy. Nearly every item of saving is expounded to its greatest possible magnitude, so that a few cents saved on one car mounts up into a tremendous sum when multiplied by the million of cars in the country. For instance, he says: The gold leaf required for the decoration of a not very ornate passenger car costs about $7.20. Aluminum leaf for the same would cost 74 cents. The labor for complete decoration of such a passenger car, including gilt and black lines, stripes, letters and figures, costs about $21.04 per car. If the decorations were reduced to the simple name of the road on the letter boards and four numbers on the sides, this could all be done for about $4 per car; or for 34,200 passenger cars in the United States and Canada, this would represent $581,400, and interest at 5 per cent. on this would be $29,070.

The author wants to throw out of the passenger cars nickel-plated spittoons, Brussels carpets, basket racks and a variety of other things that cost money. In attacking the existing luxurious finish and trappings of the passenger car, the author does not carry his reasoning to its logical conclusion. Why not make a passenger car as inornate as a box car. Why not paint it inside and out with oxide of iron paint, put on by the spraying system, and carry it on diamond trucks with coil springs? To be sure coil springs have been abandoned on stock carrying lines, because the cars rode too rough for the health of steers, but he has recommended the coil spring for locomotives that men ride upon, and passengers ought not to be treated in a more luxurious fashion.

Any kind of policy or practice that is good for a corporation is likely to be good for an individual or for a nation. Mr. Sanderson advances arguments after their kind in favor of railroad companies doing without everything not absolutely necessary for the safe transportation of passengers and freight, and makes out the whole saving to be clear gain. Now let us apply some of Mr. Sanderson's reasoning in favor of railroad companies entering into a variety of petty, mean practices, to his own case as an individual and to the country at large. Probably he wears shoes that are polished once a day at a cost of 5 cents or 35 cents a week. There are probably five millions of people in the United States who get their brogans polished daily at a cost of 5 cents, to say nothing of those who pay 25 cents in the sleeping cars and 10 cents or more in the hotels. But to be fair we will make it an average of a nickel. Now, that represents the enormous sum of $250,000 daily. Is the polishing of shoes anything more than a piece of vanity? We believe not, but nearly everybody who can afford it indulge in that kind of vanity. If the author of the paper will stop having his shoes polished and inaugurate a crusade against the practice, and succeeds in stopping it, will he do any good to the world or make anyone richer by that daily saving of $250,000? No. He will merely accelerate the cheapening curse which has overtaken every nation through formidable restraints on the distribution of the products of labor.

Of much greater value to railroad companies than petty savings is popular good will, and all intelligent managers recognize that fact. When people come to recognize that railroad companies put no limit to meanness in their efforts to effect petty savings, influences will be roused that will make it a dear policy. Individuals, if properly constituted, like to make their homes and surroundings pleasant. They do not banish pictures, carpets or bric-a-brac, because they are luxuries not essential to existence. There is no reason why railroad companies should differ from individuals in this respect, and we do not believe that it would promote their dividend earning power to make the difference too conspicuous.

Patenting Other People's Inventions.

There is a very wise rule followed by many railroad officials who devise improved mechanical appliances for the use of the company they serve to have the devices patented if their use can be protected by such means. This is done very often when no expectation is entertained that the patented article will ever be put on the market. Sad experience has taught real inventors that it is necessary to cover the products of their ingenuity with patents to prevent certain sharks from patenting on the quiet the other man's invention, and after years presenting claims for infringement. Claims of this fraudulent character have not only been pushed frequently, but have often been collected. We have known several cases where claims for infringement have been paid because it was cheaper to pay the unjust royalty than to enter into an expensive lawsuit.

Railroad companies appear to have suffered more from the inflictions of the patent shark than any other interest. The trick of patenting another man's invention and then prosecuting the user for infringement of the patent began early, and is still going on. The first spark-arrester ever used upon a locomotive was the object of a lawsuit by a shark patentee. When the first locomotive was put to work on the Camden & Amboy, the genesis of the Pennsylvania system, rich pine wood was used for fuel, and the open smoke stack vomited sparks like a miniature volcano, setting the country on fire. Isaac Dripps, who was master mechanic of the road, proceeded to design a spark arrester. He applied an inverted cone at the top for deflecting the cinders, used an inside pipe for the passage of the gases and made an outside casing that formed a recess for holding the sparks. He did not think the device was worth patenting, but it became the model on which all successful smoke stacks for wood-burning were made for many years, and would have brought a huge fortune to the inventor had it been patented.

Five or six years after Dripps' smoke stack was in use a shark came along, took notes of the device, and secured a patent upon it. He had stolen property worth keeping, and he made no claim until the life of the patent was nearly expired. By that time he supposed memories would be blunted as to the particulars about the first use of the smoke stack, and he entered suit against the Camden & Amboy for the collection of royalty on his patent. The suit was tried, and the evidence of those who had a hand in making the stack was too much for the would-be swindler.

The railroad associations established years ago as a sort of insurance against patent swindlers have done much to suppress the business of the patent shark, but his operations are not entirely stopped. When there is a powerful railroad corporation as defender in a suit brought by worthies of this character, they always let the case drop, if a compromise cannot be effected. But individuals who are appalled at the prospect of the expense of a lawsuit to collect royalty frequently pay claims they know to be fraudulent rather than go into court. This happens most frequently when a man designs a useful device and does not patent it.

An edifying illustration of how the poor man is the natural victim of patent swindlers, is shown by the experience of a bright engineer who bought a farm with his savings, and retired to enjoy the peaceful calm of rural life, as many another trainman has done, to his endless regret. This engineer was of an ingenious turn, and he had no sooner entered upon the toils of farm operating than he began to devise mechanical aids that would lighten the drudgery of his labor. His mowing machine was first provided with an attachment which protracted the wear of the cutters; an improved clevis was applied to his plows; he devised an arrangement connected with his hay-stacking rig, which reduced the number of hands formerly needed to operate the apparatus. These and numerous other improvements were designed and made at a neighboring smithy. One of the hangers-on about the smithy was busy taking notes of the inventions. By the aid of a note-shaver of the district, one of these harpies that afflict every rural community, watching how they can turn a dishonest penny, this hanger-on succeeded in securing patents on the ex-engineer's inventions. All interest in the patents was afterwards sold for a good price to a company engaged in the manufacture of agricultural machinery.

That was not, however, the end of the case, so far as the inventor was concerned. A few years afterwards, an agent of the concern that had bought the right to the exclusive manufacture of his inventions came round to solicit orders for machinery. He went away without an order, but he noted some of the patented devices which the engineer-farmer was using, and carried the information home. A few days afterwards the farmer received notice that he was infringing the patents controlled by the agricultural machine making concern, and a bill for royalty was sent in. He paid no attention, and used unhallowed language to an agent who called, trying to collect the money. Time went on, and a suit was brought against the inventor who failed to take out patents. He went to a lawyer, breathing defiance, and was prepared to prove that the devices used were his own invention. The lawyer knew better about the difficulties of producing satisfactory proof in a case of the kind, where the patentee is presumed by the law to be the inventor, and the sensible advice was given, to pay the royalty.

That was the last straw to break the engineer-farmer's faith in rural simplicity or in the infinite harmonies that pervade country life. The day after the lawyer had given him advice to settle with the rogues, he was at the office of his old master mechanic, asking for a job. He is running an engine again, and says the life is more tranquil than that of farming.

The Combustion Chamber and the Big Flue.

In a paper recently read before one of the railroad clubs by an assistant superintendent of motive power, a man who has few peers in engineering experience and ability, the following sentences are found: "Combustion chambers have their uses and merits in stationary and marine boilers of certain kinds and sizes, but to shorten the flues of a locomotive boiler from 6 to 14 inches to introduce separate flue and flanged throat sheets, with the concomitant endless troubles from cracks, leaks and broken braces, etc., sacrificing, at the same time, a hundred or so of square feet of valuable heating surface, all to get 6 or 14 inches space in the front of the firebox for combustion-chamber purposes, seems like carrying a fad a little too far. When the velocity of gases is considered, of what possible use can such combustion space be?"

This is a practical question concerning the design of locomotive fireboxes which is almost as old as the locomotive itself. There were few locomotives sounding out their echoes of progress in the United States when certain savants found out that the firebox surface was much more efficient in extracting the heat from the fuel gases than the tube surface. They concluded at once that the proper thing to do was to increase the firebox surface, even at the expense of reducing the flue surface. Their belief was true, so far as the value of the firebox surface was concerned; but when they proceeded to increase the firebox surface at the expense of the tube surface, they were getting into deep water. To carry out the principle logically, the right thing to do would have been to make the firebox a huge flue leading into the smoke box. The early engineers all remembered the bad steaming qualities of locomotive boilers made with a single, or even a return flue, and so they did not care to carry their theories to the smoke box. Instead of that, they made a combustion chamber where the fuel gases were to be mixed before they entered the flues, and imagined that they had struck the grand mean for taking all possible heat out of the fuel.

Under this sentiment a great many combustion chambers were introduced into locomotive fireboxes, and some of them are to be found in use to-day. We have had considerable experience with that medium for increasing the steaming capacity of locomotive boilers, and we have seen not a few changed to a plain firebox with increased length of flues equal to the original depth of the combustion chamber. But we have never seen this change made where the engine did not steam better and do its work with less consumption of fuel than it did when the combustion chamber was in use. We think we can safely say that no man who has run a locomotive under these changed conditions has had different experience from our own.

The sheets of the firebox where the heat is generated naturally absorb more heat per unit of surface than the parts farther removed from the heat-generating point, because the act of heat-absorption cools the gases. By the time the gases pass away from the point of heat supply, they are becoming comparatively cool, and the only way to extract the remaining heat from them successfully is to pass them through flues of small diameter, where the remaining heat will be absorbed by the large cooling surface compared to the volume of gases passing through. If the gases pass through a large chamber and then into a large tube, the center of the volume will not touch the surface that is in contact with the water, and will pass off at a higher temperature than they would do if the passage were smaller. That is why combustion chambers and large tubes are never satisfactory.

There has been a theory that a combustion chamber and large tubes are necessary to complete the act of combustion that has begun in the firebox, and there seem to be very plausible reasons to support the idea; but they have never come out right in practice. As the result of practice is the final test of the value of all theories, we must conclude that while the combustion chamber and the big flue offer alluring savings of heat, they have never come up to their promise.

Rules for Punishing Men in Case of Accident.

The American Railway Association has labored very successfully for several years to produce rules for the movement of trains that would be intelligible to the ordinary railroad man: and there is no doubt that their labors in a much needed reform have saved many thousands of dollars to railroad companies and have kept in life and in the pursuit of happiness many persons who would have been in their graves under the accidents that would have resulted from the use of the old confusing rules. This is very good as far as it goes, and the authors of the reforms deserve unstinted praise, but there is a good deal still to be done for regulating train movement which the association ought to take vigorously in hand. In the old days there was a saying that train rules were made to put them in the hole when any accident happened and to exonerate the management from blame. That was undoubtedly true, and the worst of it is that the modern rules are not exempt from the same charge of unfairness. The association's rules are based on equity and all-round common sense, but railroad companies are in the habit of adding private rules of their own which are statutes of unfairness. We read recently the train rules of a transcontinental road in which the enginemen of all trains were prohibited from passing stations at a greater speed than six miles an hour, and we were informed that certain men had been severely punished for violating that rule when accidents happened, and yet it was well known that no through train could make running time on certain divisions unless the rules were broken. We believe that rules of this character never do any good, and that they develop bad feeling between the men and the companies. It seems to us that the railroad companies keeping rules of this kind as a club for their men are ashamed to show them to the light of intelligent discussion. If the American Association should insist that no rules ought to be read for train movement without being submitted to the association, we are persuaded that abuses of the kind mentioned would cease with advantage to all concerned.

Some Urgent Needs.

The large locomotives of to-day have brought us to a realization of some needs that would be winked at in the smaller fry. Among these we find the old small cast-iron headlight step to be one demanding extinction as a necessary part of a locomotive. It has been continued for years after its usefulness had been buried in a dead past, because it was supposed to be of some assistance in reaching the headlight on the class of engines that had low boilers.

Those little mantraps have been responsible for many a fall, and should never have had a place on the smoke arch of an engine, for the reason that they presented barely surface enough for one foot to rest on while a headlight was being lighted or cleaned. Long practice makes a man enough of an acrobat to perform the lighting act, for no time can be wasted with a lighted match; but when it is necessary to continue the aerial performance long enough to clean and fill the lamp, something more stable than a one-legged perch is required on our present high boilers.

One road, and one only, as far as our

knowledge of the situation goes—but there may be others—has made any attempt to put up something that can be called a proper foundation to stand on while inspecting or doing work on a headlight, and that road is the Kansas City, Fort Scott & Memphis. Superintendent of Motive Power Nettleton has seen the need of action in the case, and met it with a running board, about 24 inches long by 12 inches wide, duly bracketed to the smoke arch at such a hight and position as to make it a pleasure to do work on a headlight.

Room for improvement can also be found lower down, when we think of the difficulties encountered in making an effort to get under moguls and ten-wheelers. The drivers on those engines are in almost every case so close together as to wholly prevent a man getting between them on the ground. Access must be had, then, by way of the top of frames, and a step placed at the back cylinder head furnishes a convenient means of getting there. This need may appear trifling to those who never have to deal with a slipped or broken eccentric or a hot driving box, but it assumes giant proportions when it keeps a man off of some other fellow's time.

There is apparently very little importance attached to the necessity of getting under an engine, if we may judge by the way all avenues are blocked. Notwithstanding it is almost absolutely impossible to get under between the wheels, there is a tendency to choke up the best remaining place—that is, the space immediately behind the saddle—by filling the space with the main air reservoir. This situation is not so glaring while an engine is over a pit; it is on the road that it assumes a magnitude calling for a kick long drawn out.

Train Men and Kidney Trouble.

We hear a good deal about train men having a tendency to suffer from kidney troubles, and the impression prevails that the vibration of the cars or locomotives produces this affliction. A well-known physician who has had good opportunities of studying the maladies of railroad men, while talking recently to the writer on the subject, strongly insisted that the vibration did no harm; that those who acquired kidney disease in railroad service had the malady developed by other causes. "It is difficult," said the doctor, "to follow the habits of a train man, while on duty, sufficiently close to identify influences which might lead to serious consequences; but I shall give you particulars of a case from which useful inferences may be drawn." Then he continued:

"I have a case now of the engineer and fireman of a small stationary engine plant, who is in the early stages of Bright's disease; but they will be continuous, and will cause his death. He has been a remarkably robust man—perfect as a human type in all respects—and it puzzled me for months to account for his present condition, as he leads a temperate life. On questioning him about his habits, I found out that the boiler room was very hot in summer, and in consequence he worked with little clothing beyond his flannels. He was a full-blooded man, and felt the heat, and he was in the habit of frequently stepping into the cool draft at the open door and cooling off. There is no doubt," continued the doctor, "that this 'cooling off,' the violent physical reaction, brought on the germs of Bright's disease."

Although a brother of the writer, who is one of the most eminent physicians in Great Britain, has frequently remarked, "One of the most dangerous things a man heated by violent exercise, or otherwise, can do, is to cool off quickly," we do not pretend to explain the source of the danger. But the inference to us of what these scientific physicians have said is, that it is a dangerous thing for an engineer who has got heated, to open the front window and enjoy the refreshing current of air that passes through his garments. It is pleasant for a fireman, when he has toiled with the scoop until a few minutes of rest come, to get out into the gangway to let the fresh air of earth cool his perspiring person. Not altogether from choice, but with something approaching pleasurable change, the brakeman sweating over the caboose stove jumps quickly upon the top of cars to set brakes and enjoys the rush of the frosty air.

That fresh, stimulating air, when applied to a heated body, contains the worm that generates kidney trouble. Unless promptly checked, kidney trouble becomes Bright's disease, which is as certainly fatal as consumption.

BOOK NOTICES.

"The Strength of Materials." A Text Book for Manual Training Schools. By Mansfield Merriman, Professor of Civil Engineering in Lehigh University. Published by John Wiley & Sons, New York, and Chapman & Hall, Limited, London. Cloth. $1.00.

This work, while of an elementary character, is written for the more advanced students of manual training schools and those whose mathematical attainments include algebra and geometry, and who have also had a course in elementary mechanical physics; the object of the work being to put the subjects treated within the comprehension of those not up in the calculus. This the author has done by an avoidance of Greek characters, and reducing algebraic expressions to their simplest form. This book is needed, and will be gladly welcomed by a large number of working students who are obliged to investigate the design of beams and the subject of moment of inertia without the aid of a teacher. The work will be found in our book department.

"Year Book of Railway Literature," compiled by Harry Perry Robinson. The "Railway Age," Chicago. Price $1.

This is the first volume of what is going to be an annual publication to put into permanent form all papers or addresses on the public relations of railways that have appeared during the past year, and which seem to be of sufficient value to be put in permanent form. The selections appear to have been very judiciously made, and all the articles contained in the book are well worthy of preservation. Among those published are seven articles, on "Railway Pools; Their Equity and Public Value," by George R. Blanchard; "The Industry of the Rail," by E. B. Thomas; "An Address to Railway Men," by E. T. Jeffery; "Railways—A Retrospect," by M. E. Ingalls; "Railway Rates and Earnings in Kansas," by E. P. Ripley; "Are American Railway Rates Too High?" by H. T. Newcomb; "The Plight of the Railways," by Robert P. Porter; "The Scalping of Railroad Ticket," by George H. Daniels, and a variety of others of almost equal value.

"A Romance in Transit." By Francis Lynde. Charles Scribner's Sons, New York. Price 75 cents.

This is a railroad story from beginning to end, and is a pleasant addition to a department of literature which is exceedingly meagre, considering the opportunities that the field offers for stirring romantic stories. A great many railroad stories have been written, but most of them are the work of gushing people who know nothing about railroad life and reveal their ignorance on every page. Railroad men have no use for writings of that kind, although they are prone to read things of a romantic nature which read as if they really happened.

The author of "A Romance in Transit" may not be a railroad man, but he certainly is accurately familiar with railroad life, and makes out a story of natural surroundings. The plan of the story may be open to criticism, but the filling up is perfect. An assistant passenger agent, who is also a machinist and engineer, is escorting a party of sight-seers from Chicago to Denver, and the private car of a railroad president is on the same train. The A. P. A. had met the president's daughter the previous year and fell in love with her. The story turns upon the adventures of this couple.

"The Universal Carpenter and Joiner and Wood-Worker's Assistant." Part first. By Fred T. Hodgson. Published by the Industrial Publication Company, 16 Thomas street, New York. Paper cover, $1.

This work is compiled and edited for the express use of the wood-working mechanic, and is designed to put him in touch with the geometry of his business by practical examples of moldings. Gothic arches and turned work, of a character only followed by the best paid of the craft. The application of the carpenter's square to the construction of polygons is not the least interesting feature of the book, and the chapter on drawing instruments and their uses is very good for beginners in the art.

It is the intention of the author to issue five parts, each complete in itself, the price of the five numbers to be $5. There are 250 illustrations and 180 pages in the initial number, all of the greatest interest to the wood-worker. We handle this work in our book department.

"The Power Catechism." Power Publishing Company, New York. Price $2.

This is a catechism collected from the pages of *Power*, and covers all the principal practical subjects relating to the care of boilers. The scope of the work may be understood from a few of the headings of the fifteen sections into which the book is divided. Among them we find Classifications of Boilers; Bursting Pressure; Riveting Joints, Braced and Stayed Surfaces; Combustion and Firing; Heating Feed Water; Horse-power of Engines; The Slide Valve; The Corliss Engine and Engines in General. The book will be found of great value and interest to stationary engineers.

"American Railway Management," by Henry S. Haines, New York. John Wiley & Son. Price $2.50.

The author of this book has been one of our best known railroad managers. He was for years vice-president and general manager of the Plant system, and was well known as president of the American Railway Association, the interest of which he worked most vigorously to advance, and with much success. The book consists of a collection of addresses delivered by Col. Haines on a great variety of topics of value and interest to railroad men. The addresses are well worthy of preservation, and we are glad to see them collected in book form. The book ought to be in the library of every railroad man interested in his business.

Annual Report of Traveling Engineers' Association.

"The Proceedings of the Fifth Annual Convention of the Traveling Engineers' Association." Edited by W. O. Thompson, secretary, Elkhart, Ind. Price 75 cents bound in cloth, and $1 bound in Russia leather.

This highly interesting report, which has just reached us, contains 254 pages of the standard size. It is one of the most interesting reports of technical society proceedings we have ever read, and we cordially recommend it to all our readers who are interested in the running and management of locomotives. The reports show very careful research and painstaking compiling. They are all so good that we can hardly with justice select one for commendation above the other. The discussions contain the ready expressions of the most practical kind of practical men, and are full of sound and useful information. The report is for sale in this office.

No Demand for Railway Men in China.

We have repeatedly warned railroad men against paying any attention to lying reports that emanated from New England, to the effect that railroad men were in demand in China. We had the best reasons for believing that the reports to this effect were deliberate lies, and said so; but still we have continued to receive inquiries about whom to apply to for employment on the railroads in China.

We are now able to give official information, contained in the report of United States Consul-General Goodnow, at Shanghai. The Consul-General reports as follows:

"The American only invites starvation who comes here without a definite contract of employment with some reputable firm made before he leaves America. I must advise United States railway employés that there is at present no market for their labor in China, and should more roads be constructed, there will be a market only if these roads are built by Americans."

The Consul-General says he has had many inquiries from American railroad men as to the chance for employment in China, so he describes the small Chinese railroad system, to show the hopelessness of looking in that direction for work. There are only two railways in operation, with a total mileage of 293½ miles. They employ only twenty-seven foreigners, of whom four are engineers, managers and division superintendents. The operatives are practically all Chinese, and a foreigner cannot compete with them.

The highest-salaried natives are the telegraph operators, at $40 per month. Engineers get $20 to $30, and trainhands and trackmen $6 to $10 per month. All of this is in Mexican silver, worth 44 cents gold on the dollar. The roads are paying 15 per cent. dividends. Another road is under construction from Shanghai to Woo-Sung, fourteen miles, Chinese doing all the work, and the first sod was recently turned on the projected road from Hankow to Peking, the completion of which depends upon the success of the Belgian syndicate in floating its loan.

Mr. Goodnow recounts the ambitious schemes of Director Sheng, of the Imperial Railways, to create a vast system of railways in Central China, and incloses a map showing the projects. He says Sheng's plan is to build these roads as money can be borrowed outside of China. He proposes to couple with the railway loans a government loan of $80,000,000 to pay the balance of the Japanese war indemnity. In this way the option of building the Chinese roads would be held out to the parties taking the government loan, and the support of foreign governments for the government loan would be secured by allowing the successful syndicate to furnish all the material and skilled labor needed for the railroads. Mr. Goodnow points out that under these conditions there will be no market for American railway material or labor, unless Americans furnish the money to build the railways.

The joint committee of the Master Car Builders' and Master Mechanics' Associations, which met at Niagara Falls recently, have decided that the next convention will be held at Saratoga. The committee made a very thorough investigation of the various places where accommodation could be secured for the convention, but they had finally to fall back upon Saratoga, as all the other places were deficient in hotel accommodation. Congress Hall will be the headquarters of both associations, as usual. At the last convention, a resolution was carried by the Master Mechanics' Association recommending that the two conventions should be held during the same week, each association taking alternate days for the transaction of business. Efforts in this direction have been made repeatedly, but without success. It appears that the members representing the Master Car Builders' Association refused to agree to the plan proposed by the Master Mechanics' Association.

Aretas Blood, who died at Manchester, N. H., on November 24th, aged 81 years, has been identified the most of his busy life with the mechanical history of his country. In 1853 he established a machine company in Manchester, which was afterwards incorporated as the well-known Manchester Locomotive Works. In 1872 Mr. Blood secured control of the fire apparatus business of the Amoskeag Company, and made a specialty of fire engines, putting out the first horseless machine at that time. He was remarkably successful as a business man, being owner of a cotton mill, president of a bank, president of a cotton and woolen mill, and also of a paper mill, besides being a vice-president, treasurer or director in many other companies.

Through the courtesy of Secretary Moseley, we have received an advance copy of the "Eleventh Annual Report of the Interstate Commerce Commission." It contains the usual valuable information to be found in this volume, and we will draw upon it from time to time for extracts, giving information which we think our readers will be interested in.

PERSONAL.

Mr. John E. Stearns, general manager of the Boise, Nampa & Owyhee, of Idaho, has resigned.

We will give 25 cents or allow that amount on subscription for copies of our issue of August last.

Mr. W. W. Layman, master mechanic of the Ohio River Railroad, at Parkersburg, W. Va., has resigned.

Mr. F. P. Boatman, recently appointed master mechanic of the Columbus, Sandusky & Hocking, has resigned.

Mr. Wm. Voss, the well-known master car builder, has been appointed superintendent of the Ohio Falls Car Company.

Mr. C. M. Stansbury has been appointed master mechanic of the Pecos Valley, vice Mr. G. F. Miller. Headquarters at Eddy, N. M.

Mr. Patrick S. O'Rourke, superintendent of the Southern division of the Grand Rapids & Indiana, at Ft. Wayne, Ind., has resigned.

Mr. W. W. Wilson, assistant general manager of the Gulf, Beaumont & Kansas, has been appointed treasurer. Office at Beaumont, Texas.

Mr. George F. Evans, general manager of the Maine Central, was elected vice-president at a meeting of the directors of that road in November.

Mr. Charles Laws has been appointed general foreman of the St. Louis Southwestern shops, at Tyler, Texas, vice Mr. William Shiermann, resigned.

Mr. H. H. Lane, secretary of the Mobile, Jackson & Kansas City, has been promoted to the position of superintendent; headquarters, Mobile, Ala.

Mr. Ira C. Hubbell, purchasing agent of the Kansas City, Pittsburg & Gulf, has also been appointed purchasing agent of the Omaha, Kansas City & Eastern.

Mr. W. A. Simmons has been chosen president and general counsel of the Carrabelle, Tallahassee & Georgia, with headquarters at 29 Broadway, New York.

Mr. J. C. Nickolas has been appointed general foreman of repair shops of the Mexican National, at the city of Mexico, vice Mr. R. W. McConnell, resigned.

Mr. D. E. Maxwell, general manager and purchasing agent of the Florida Central & Peninsular, has been chosen vice-president, in addition to his former duties.

Mr. Charles H. Voges, gang foreman, has been promoted to the position of general foreman of the "Big Four" shops, at Bellefontaine, O., vice Mr. Timlin, resigned.

Mr. F. W. Fratt, superintendent of the Texas Midland, at Terrell, Texas, has resigned to accept the position of superintendent of the Galveston City Street Railway.

Mr. W. J. Corrington has been made manager of the St. Louis branch of the Davis & Egan Machine Tool Company. He was formerly connected with the main office, at Cincinnati, O.

Mr. W. R. Ellis, of the Pullman Car Company, has accepted the position of superintendent of the Missouri Car Wheel plant, to be established in the Madison Car Works, Madison, Ill.

Mr. D. J. Timlin, general foreman of the "Big Four" shops, at Bellefontaine, O., has résigned to accept the position of machine-shop foreman of the Wabash Railroad, at Moberly, Mo.

The Oregon Improvement Company has been reorganized under the name of the Pacific Coast Company, and Mr. C. J. Smith, receiver of the old company, has been made general manager.

Mr. A. R. Anthony, trainmaster of the Philadelphia & Reading, has been appointed assistant superintendent of the Shamokin division of that road, with headquarters at Catawissa, Pa.

Mr. Henry B. Spencer has been appointed assistant superintendent of the Alabama Great Southern, with office at Birmingham, Ala. He is a son of President Spencer, of the Southern Railroad.

Mr. E. Fisher has resigned as assistant superintendent of the Michigan Central, at Jackson, Mich., to accept the position of general superintendent of the Toronto, Hamilton & Buffalo. Headquarters at Hamilton, Ont.

Mr. W. T. Godfrey, of the Oregon Short Line shops, at Pocatello, Idaho, has been appointed master mechanic of the Salt Lake & Ogden Railway, vice John Hurst, deceased. Headquarters at Salt Lake City, Utah.

Mr. W. H. Carson, superintendent of the Arkansas & Choctaw, has been appointed assistant general manager, and Mr. C. M. Boswell has succeeded him as superintendent. Both have headquarters at Texarkana, Tex.

Mr. E. La Lime, superintendent and master mechanic of the New York & Ottawa Railroad, at Santa Clara, N. Y., has resigned to accept the position of master mechanic of the Ohio River Railroad, with headquarters at Parkersburg, W. Va.

Mr. Charles T. Means has been chosen to succeed the late Aretas Blood as agent of the Manchester Locomotive Works, Manchester, N. H. Mr. Means has been connected with the corporation for twenty-four years, and has for several years been the acting agent.

Mr. T. M. Downing, master mechanic of the "Big Four" shops, at Delaware, O., has been appointed superintendent of motive power of the Columbus, Sandusky & Hocking Valley, vice Mr. F. P. Boatman, resigned. Mr. Downing was formerly master mechanic of the Elgin, Joliet & Chicago.

There have been a number of changes recently in the management of the Lima Locomotive & Machine Company's Works. Mr. W. C. Mitchell, of Texas, has been chosen general superintendent; Mr. Wm. T. Harps assistant to Mr. Mitchell, and Mr. A. J. Bean has been promoted to foreman of the erecting shop.

Mr. Charles Russell has been appointed superintendent of the Rocky Mountain division of the Northern Pacific at Missoula, Mont., vice Mr. E. J. Pearson transferred to the Pacific division of the same road at Tacoma, Wash. Mr. Russell has been a roadmaster on this division for five years, and is a practical railroad man.

Mr. Adam Ray, after running an engine on the Baltimore & Ohio for exactly forty-five years, was retired on September 30th last. "Pap" Ray, as the trainmen call him, was singularly fortunate in his long career as engineman, having only been in one serious accident, caused by a lap order. He is now sixty-five years of age, and considers that age much too early to retire, and he is looking for a new position.

The Kansas City, Pittsburg & Gulf has assumed control of the Omaha, Kansas City & Eastern and Omaha & St. Louis Railroads, and President A. E. Stilwell announces the following changes: Mr. Robert Gillham, general manager and chief engineer, Kansas City, Mo.; Mr. John M. Savin, assistant general manager and general superintendent, Quincy, Ill.; Mr. F. Mertsheimer, superintendent of motive power and equipment, Kansas City, Mo.; Mr. John N. Voorhis, division master mechanic, Quincy, Ill., and Mr. C. E. Soule, superintendent, Quincy, Ill.

The following changes have been made on the Marquette route: Mr. J. J. Conolly has been appointed superintendent of motive power and machinery of the Duluth, South Shore & Atlantic Railway; Mineral Range Railroad and the Hancock & Calumet Railroad. Mr. J. C. Shields has been relieved of the duties of master mechanic of the Mineral Range and Hancock & Calumet Railroads, and will hereafter devote his entire time to the operation of these two roads. Mr. C. G. Mingay has been appointed master mechanic of the Mineral Range and Hancock & Calumet Railroads, and will, under the direction of Mr. J. J. Conolly, have charge of the motive power and machinery.

EQUIPMENT NOTES.

The Toledo Oil Works are having five cars built by Murray, Dougal & Co.

Morris, Nelson & Co. are having fifty cars built by the Illinois Car and Equipment Company.

Three six-wheel connected engines are being built for Russia at the Baldwin Locomotive Works.

The Lima Locomotive and Machine Company are building six cars for the Manhattan Oil Company.

The Pittsburg, Bessemer & Lake Erie have 400 cars under construction by the Schoen Pressed Steel Company.

The Wells, French Company are engaged on an order of 200 freight cars for the Swift Refrigerator Company.

The Pullman Palace Car Company are building 200 freight cars for the Kansas, Memphis & Birmingham Railway.

Five consolidation engines for the Beech Creek Railway are under way at the Schenectady Locomotive Works.

The Allison Manufacturing Company are working on an order for 350 freight cars for the Central Railway of Brazil.

The Pittsburg, Bessemer & Lake Erie have ordered two consolidation engines from the Pittsburg Locomotive Works.

Four six-wheel connected engines are being constructed at the Baldwin Locomotive Works for the Texas Pacific Railway.

The Chicago, Lake Shore & Eastern Railway are having twenty-five cars built by the Illinois Car and Equipment Company.

Murray, Dougal & Co. are building four cars for the Eagle Cotton Oil Commany, and one car for the Empire Oil Works.

The Columbus, Hocking Valley & Toledo railway are having 200 freight cars built at the Michigan Peninsular Car Works.

The Chicago & Eastern Illinois Railway have an order for ten freight cars under way at the Haskell & Barker Car Works.

The Detroit, Grand Rapids & Western Railway are having 250 freight cars constructed by the Michigan Peninsular Car Company.

The Atchison, Topeka & Santa Fé have placed an order with the Dickson Locomotive Works for five heavy consolidation engines.

Five hundred freight cars are under construction by the Missouri Car and Foundry Company for the Missouri Pacific Railway.

The Dickson Locomotive and Machine Works have under construction, for the Sanyo Railroad, of Japan, two six-wheel switch engines.

The Cooke Locomotive Works have received an order for one ten-wheel engine from the Bangor & Portland Railroad Company.

It is reported that an order has been given to the shops of the Atchison, Topeka & Santa Fé to build twelve consolidation locomotives.

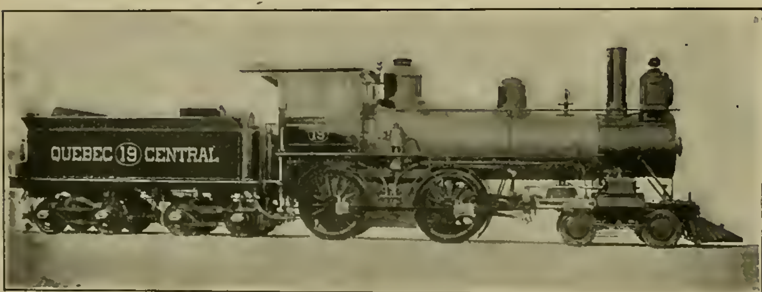
The Schenectady Locomotive Works are building ten six-wheel connected engines for the New York, New Haven & Hartford Railroad.

The Schenectady Locomotive Works are turning out an order of ten eight-wheel engines for the New York Central & Hudson River Railroad.

The "Big Four" are having one consolidation engine built at the Richmond Locomotive Works, and six six-wheel connected engines built at the Brooks Locomotive Works.

H. K. Porter & Co., of Pittsburg, have recently received an order for two compressed-air engines for the Cambria Iron Company, of Johnstown. These engines will be used for mining purposes, for which they are admirably adapted. They are six coupled and give a much better adhesion than the four-coupled compressed-air engines previously used.

A recent high wind in Jersey blew the bell off one of the Royal Blue flyers the other day. We don't know whether to credit this entirely to the wind or not, but rather lean to the idea that there was some deucedly weak spot on some of the fastenings.



CANADIAN LOCOMOTIVE.

Canadian Locomotive.

The locomotive shown has recently been built by the Canadian Locomotive & Engine Co., of Kingston, Ont., for the Quebec Central Railway.

It has cylinders 20 x 24 inches and driving wheels 62 inches diameter. The driving wheel base is 8 feet 6 inches and total wheel base 23 feet 1⅝ inches. The weight in working order is about 96,000 pounds, of which 62,000 pounds are on the drivers. The boiler is of Scotch steel ½ inch thick and 52½ inches inside diameter at the smallest ring. It is designed to carry a working pressure of 160 pounds per square inch. The throat sheet is 9-16 inch thick. Outside side sheets 7-16 inch thick. Back sheet and tube sheets ½ inch thick. The crown sheet and back sheet of fire box are ⅜ inch thick and the side sheets 5-16 inch thick. Front water space is 3½ inches; side and back space 3 inches. The stay-bolts are 1 inch diameter. The foundation ring is double riveted.

It will be seen from these particulars that the boiler and fire-box conform very closely to American practice. There are 191 2-inch tubes 11 feet 8 11-16 inches long. A No. 3 triple sight feed lubricator is used, and Garfield locomotive injectors. The United States metallic packing is used for rods and valve stems. The Westinghouse air brake is used for tender and trains and the American brake for driving wheels.

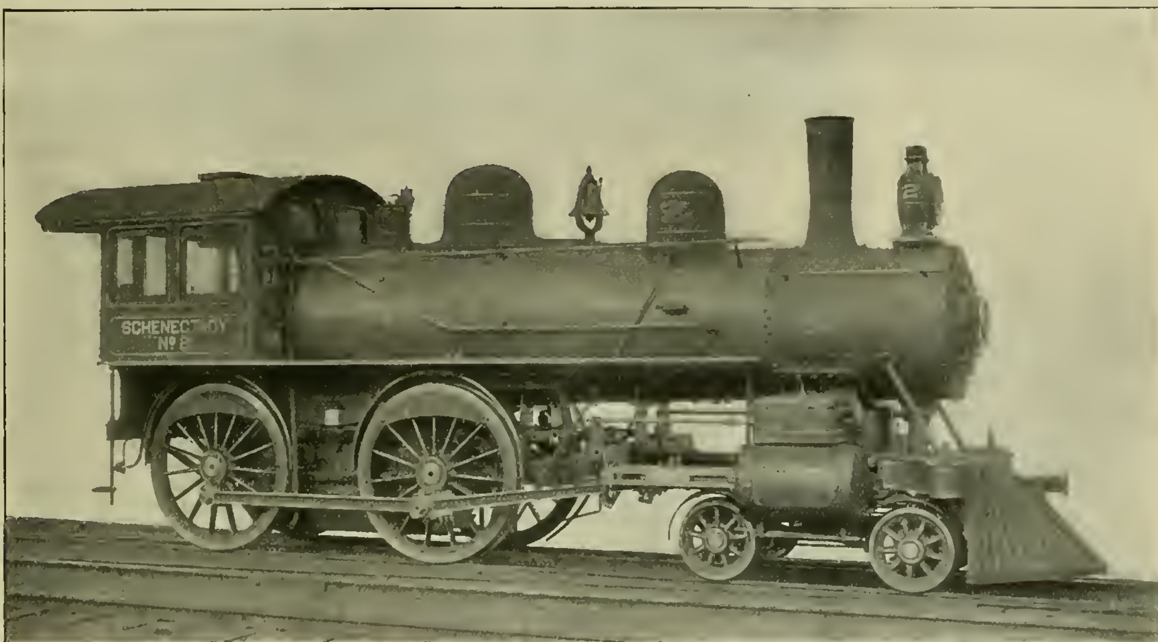
The Pennsylvania has over 90,000 freight cars equipped with the automatic coupler, and 60,000 with air brakes and automatic couplers. All the 3,700 locomotives are equipped with the automatic air-brake, and the 4,000 passenger cars with the automatic coupler and air brake.

The Interstate Commerce Commission has extended the time for equipment of locomotives and cars with safety appliances, two years. Representatives of railroads asked for a five-year extension, which was fought by the representatives of labor organizations. The action of the Commission is therefore a compromise for the warring interests at the Washington hearing, in December.

Judge Seaman, of the United States Circuit Court, has entered a decree in the case of the Central Trust Company of New York against the United States Car Company, in which he orders the defendant to pay to the court within ten days $2,018,708.32. The money is due the complaining company for principal and interest upon certain first-mortgage bonds and coupons. In case of default in the payment ordered, the court also decrees that Master in Chancery Sherman is authorized to advertise the plant of the company at Hegewisch, Ill., to be sold at auction.

Schenectady Locomotive No. 2, for Purdue University.

Nearly all railroad men are familiar with the fact that several years ago the Schenectady Locomotive Works built for the Purdue University an eight-wheel locomotive for their engineering laboratory, on which tests were made that settled many problems in locomotive engineering which were previously matters of guess and contentious speculation. The locomotive proved exceedingly useful, so far as its capabilities were concerned; but advances in the art of steam engineering left it behind, and it was necessary to secure something more in line with modern locomotives to keep the engine up to the highest measure of usefulness. This seems to have been achieved in a locomotive recently built by the Schenectady Locomotive Works for the university named, and shown in the annexed engravings.



SCHENECTADY LOCOMOTIVE FOR PURDUE UNIVERSITY.

In general appearance, the engine does not differ much from an ordinary eight-wheel engine, but it has numerous peculiarities which will render it a most valuable machine for making tests to demonstrate the value of certain cylinder proportions and conditions of operation. The most radical difference from other locomotives is in the cylinders, which can be changed in size, and it has a saddle arrangement by which the engine can be readily converted into a compound by changing one cylinder.

The intention of the builders appears to have been to make a model engine, so far as design and material are concerned, and they have used the best of everything. It may be a significant indication of coming events that nickel steel is largely used in the parts subjected to the most severe stresses. The driving axles, piston rods, crank pins and side rods are made of fluid pressed nickel steel furnished by the Bethlehem Iron Company, a material destined in the near future to eliminate well-known weaknesses in locomotive construction.

For ordinary work, the cylinders are 20 x 24 inches, and the cylinder provided for putting on to make the engine compound is 30 inches diameter. The valves are Allen Richardson, with a maximum travel of 6 inches; the outside lap is 1⅛ inches. Steam ports are 18 x 1⅝, and exhaust port 18 x 3 inches. The boiler is of the extended wagon top type, 52 inches diameter at the first ring, and built to stand a working pressure of 250 pounds to the square inch. The firebox is 72 1-16 inches long and 34¼ inches wide and 79 inches deep, which means that the firebox goes down between the frames. The grate area is 17.74 square feet.

The engine is provided with two Ashton safety valves, one of them being a muffled valve, the other an open pop. It has a McIntosh blow-off cock and a double sight feed cylinder lubricator. Two Sellers class "M" improved injectors are used. The boiler is lagged with magnesia sectional covering. Jerome metallic packing is used for piston and valve stems. A star headlight with 16-inch reflector is provided.

One Phase of the "Scalping" Question.

The agitation which is now going on regarding ticket scalping has several phases, one of which is apparently overlooked or ignored. This is, the connivance or aid which some railroads give scalpers, either openly or otherwise, and as long as this is continued, there can be little done toward abating the rate-cutting which this entails. This was particularly true of the World's Fair year, and is still true in some cases.

A friend went to the Boston ticket office of one of the largest railroads in New England, and inquired the fare to Chicago and return by a circuitous route. The rate of fare was given, but there were restrictions as to route and dates. He then crossed the street to a broker's, and was informed that they would furnish him with the ticket he desired, without any of the restrictions the railroad had named, and for about $8 less fare. He wanted a ticket, and was told to be seated a few moments.

A messenger immediately crossed the street to the very office he had come from, and brought back the desired ticket, without any of the restrictions they had named.

To a greater or less extent, this same thing is being done in most cities to-day, and until railroads stop the practice of cutting rates and aiding the scalpers' business, there is little use in wasting time in conference as to how they shall be suppressed. This phase at least is in the direct control of the roads.

It is reported that the Texas & Pacific Railroad are going to make large additions to their repair shops at Marshall, Tex. It is the intention to make the shops sufficiently commodious for the building of new freight and passenger cars.

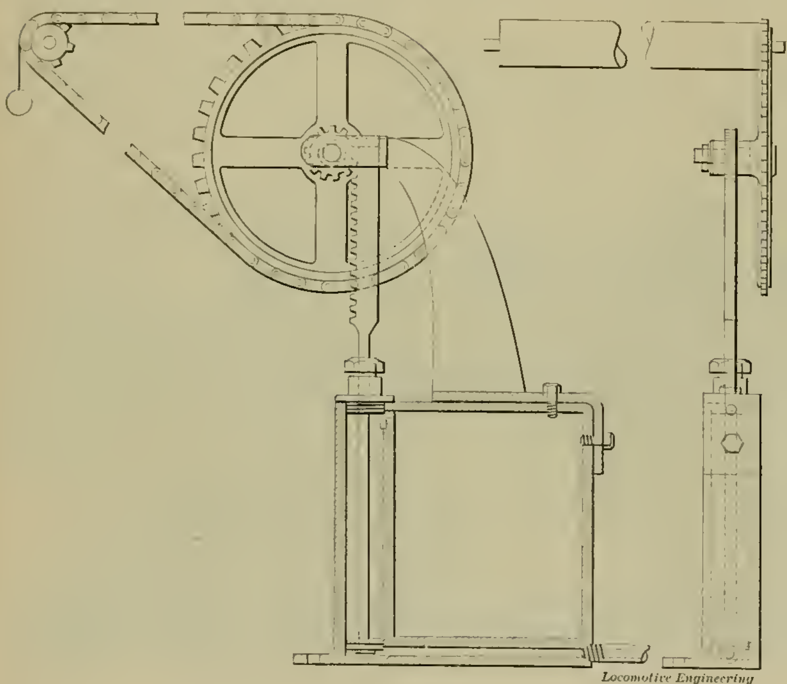
Headlight Curtain Operated by Air.

For the many years past since headlights have been obscured by a curtain when an engine was in on a siding to clear, there have been a great many ideas worked up with the view of lowering and raising the curtain from the cab, for the purpose of avoiding an encounter with the elements on stormy nights.

A scheme for this purpose is shown herewith, and one that is believed will perform its duties in every case without the necessity of a climb to the headlight to see what is the reason the "old thing don't come down." The device consists of a small casting which performs the function of a cylinder and auxiliary reservoir. To the cylinder is fitted a piston, the upper end of which terminates in a rack, into which meshes a gear wheel 1¼ inches diameter. On the same shaft with this gear is a sprocket wheel 7½ inches diameter, connecting by means of a sprocket chain with the 1¼-inch gear on the curtain roller.

A reference to the sectional side elevation will make it plain that when air is admitted to the underside of the piston, the piston will go up, and the rack will turn the gears and cause the curtain to descend and cover a 23-inch headlight glass. When the light is obscured, the piston is at the top of the cylinder and just past a small feed groove, which position allows the pipe air pressure to enter the auxiliary reservoir, and the pressures are thus equal in the system while the curtain is down.

To raise the curtain, it is only necessary to exhaust the air from below the piston, when the auxiliary pressure will force the piston down and give the proper movement to the curtain roller. This action, it is seen, is positive in both directions. The device is an ingenious and simple one for the purpose, but the necessity for the sprocket chain is not obvious, without it is designed for use inside the lamp. There is no reason why it cannot be made chainless and make an all-gear connection on the outside of the lamp. Jim Skeevers says that there should be a small pipe in this system by which to blow out the lamp, from the same three-way cock that controls the curtain. Acker, McCoskry & Molis, of Muscatine, Iowa, have patents pending for this curtain manipulator.



HEADLIGHT CURTAIN OPERATED BY AIR.

English Ideas on Rails and Track Work.

At the meeting of the Institution of Civil Engineers Mr. Harold Copperthwaite, in a paper on this subject, said:

"An ideal permanent way would be one that, lasting the longest possible time with the least possible repair, and carrying the largest and fastest trains, was so designed that all its parts would fail together, or, in other words, would require renewal at the same time; and it has been the object of all railway engineers to obtain the nearest approach to this possible under practical conditions. That they have not entirely succeeded must be admitted."

He then spoke of the almost universal employment of Baltic or Scotch fir for ties, the most of them being creosoted, and as the creosoted ties had an average life of twelve to fifteen years on busy lines (which is also the life of rails there) there is little demand for better ties.

The results with metal ties have been disappointing as the increased first cost has shown no proportionate added life. The author knows of no metal sleeper system in Great Britain which is giving good results under fast, heavy traffic.

Two Australian woods, jarrah and karri, are to be tried, and the results are anxiously awaited. They are about double the weight of the present ties, and this, it is thought, will add to the stability of the roadbed. They cost about $1.40 each at present, but it is believed this can be reduced if they are widely used.

He further says:

"All engineers will agree that a properly proportioned double-head rail of 65 to 70 pounds per yard, supported on ties 34 inches apart center to center, is strong enough to carry any loads on these islands and any additional weight is intended to be worn off."

As one-half a pound per yard is rather more than is worn off per yard during the year, he figures that it would take twenty years to wear an 80 pound rail, and forty years to wear a 90 pound rail down to the limit.

As many of our American lines are now laying 100 pound rails, they are providing for a long life—on this basis. Mr. Francis W. Webb advised against the turning of rails, as it made a noisy road, and it seemed as though the best way to break rails was to turn them.

Tests were made by substituting lead fishplates for the steel ones and noting the distortion, thus showing to what extent the rail depended on the fishplates for support. This of course varies with the way the ties are supported, in some instances as high as 95 per cent. of the failures being in the fishplate holes, due to poor tamping.

A South African Railway.

There has recently been opened the completing link of an extensive line of railways in South Africa, the entire length being 1,356 miles. The present extension is 490 miles long, and has been built in two and a half years.

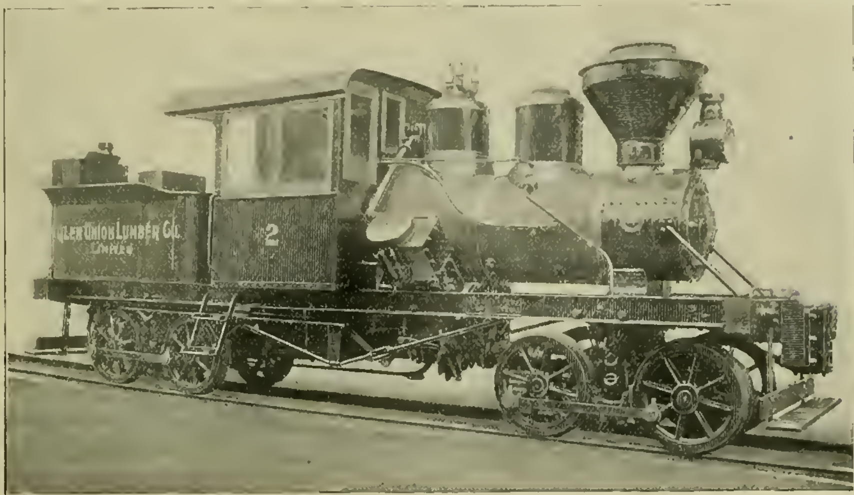
The line is 3 foot 6 inch gage, and is laid with 60-pound rails on steel sleepers. There are numerous bridges of varying spans, fifteen of them being about 100 feet.

This will reduce the time of travel from Capetown to Bulwayo from eight days to eighty hours, reduce the cost to about one-third of the former amount, and places Bulwayo within three weeks of London.

An exciting item of news, which could not wait for mail transmission, has been wired under the sea, to the effect that Dublin is going to indulge in electric cars.

Heisler Mountain Locomotive.

The Heisler locomotive has been placed upon the market with a view of meeting a growing demand for a strictly high-class



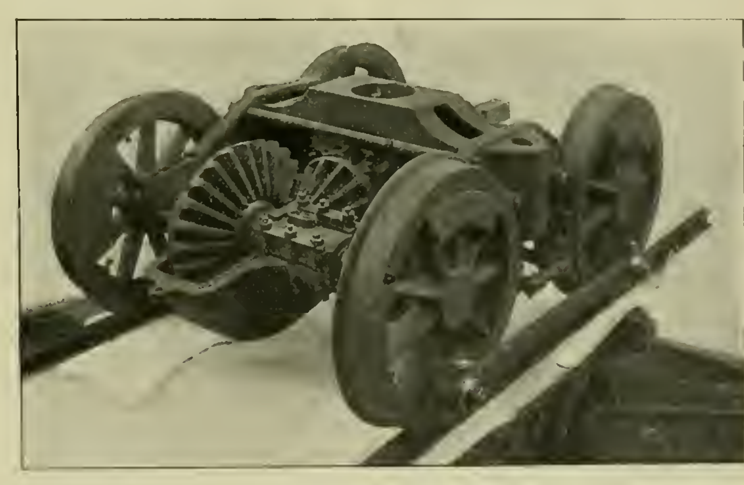
HEISLER MOUNTAIN LOCOMOTIVE.

locomotive, which in design, workmanship and material, is in no way inferior to that of the standard direct connected engines common to American railroads; and one that has an exceedingly flexible wheelbase and great tractive power, without the inherent defect common to the older styles of geared tramway engines.

In general the arrangement consists essentially of a boiler mounted upon a steel main-frame, supported at each end by two swiveling driving-trucks. A centrally located longitudinal driving shaft transmits power to the trucks from the motor-engines, which are located under the cylindrical shell of the boiler, but free therefrom and bolted to the main frame.

The boiler is of the standard locomotive type, made entirely of homogeneous steel. It is provided with a large fire-box and ample heating surface in the flues. The boiler is made with a wagon top to provide large steam room and to keep the tubes and crown-sheet submerged when on grades. The smoke-box at the front is so arranged that all the tubes are readily accessible for cleaning. The crown sheet is inclined downward at the rear to insure being submerged when on grades, and is fitted with safety fusible plugs. The front head is arranged with two hand wash-plates. One is located suitably for the crown sheet, two at the bottom of the fire-box. Two blow-off cocks are also situated there.

The valves are balanced and operated by a pair of hardened links. Instead of using four eccentric straps and eccentrics, but two heavy straps are used, thus very much simplifying the valve gear. After properly adjusting the valve, all parts are keyed so they cannot be deranged after leaving the works. The eccentric straps are provided with extra oil pockets. All the journals of the motor-engines are of bronze and adjustable for wear; likewise the cross-head gibs.



TRUCK OF HEISLER LOCOMOTIVE.

British Dining Cars.

We received from Mr. A. J. Chisholm the following letter after our correspondence columns were printed:

"The paragraph in your issue of October, 1897, respecting these magnificent vehicles, would lead your readers to suppose that they were first built in this country by the Midland Railway Company. This is not the case—in fact, the Great Northern Company built a dining saloon at Doncaster long before the Midland management had even thought of following their leader in this respect. The Great Northern car, however, was built for the convenience of first-class passengers.

"Turning, however, to the introduction of third-class dining cars, it is a well-known fact that the idea first originated on the North Eastern system. The Midland and West Coast companies (London & North Western and Caledonian), however, on learning the intention of the North Eastern management, immediately commenced building dining saloons. The Midland Company appear to have won this peculiar 'race,' for their car was on the metals some time before the others were completed."

Long Hours on German Railroads.

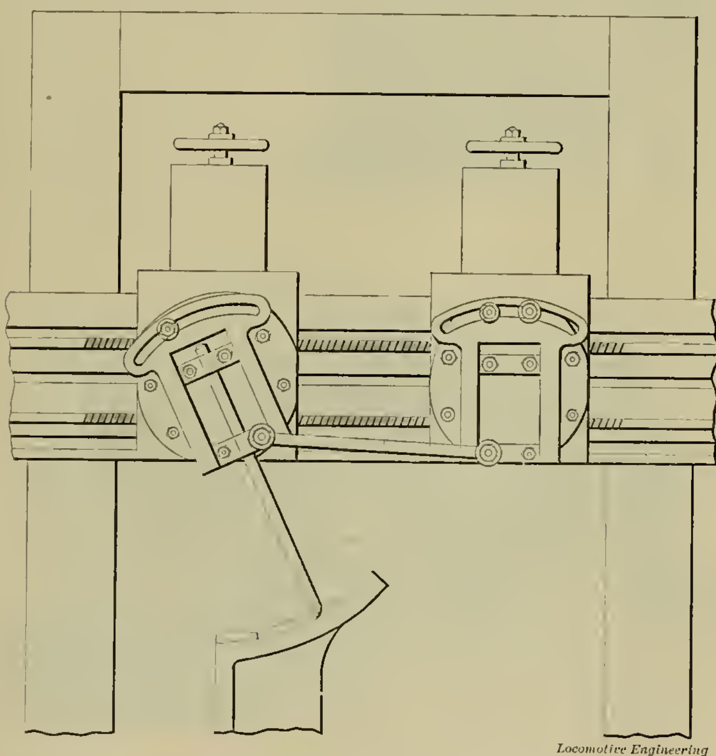
Railroad life in Germany leaves a good deal to be desired. It is stated that out of a total number of persons employed on the State railways (274,264), one-third are on duty twelve hours daily. Nearly 20,000 work thirteen hours; 12,000 are employed fourteen hours, and nearly 5,000 work fifteen hours, and a similar number sixteen hours. Among 18,844 engine-drivers and stokers, nearly 3,000 work thirteen hours a day, 2,743 fourteen hours, 1,273 fifteen hours, and 1,096 sixteen hours.

The pointsmen number 18,867, and of these 11,234 work from ten to twelve hours, 1,771 thirteen hours, 1,105 fourteen, 278 fifteen, and 202 sixteen hours. Under these circumstances it is no wonder there are frequent accidents, and that the reproach is brought against the Railway Department that a false economy underlies all these arrangements with the employés. As the income of the department exceeded expenditure last year by the enormous sum of 469,500,000 marks (£23,475,000), more liberal treatment of railwaymen is demanded.

Circular Planing on Cylinder Saddles.

The old-time hammer and chisel fit to the smoke box for cylinder saddles, with all of the time killing uncertainties of the cut and try process before the saddle is pronounced "good enough," has been replaced by General Foreman Place, of the Burnside shops, Chicago, by the arrangement shown in our engraving.

A half saddle is leveled up on the planer, and the surface that has a bearing against the smoke arch is planed by clamping the operating tool saddle to the cross-rail so as to be immovable on the latter longitudinally, but leaving the tool head free to move on its center, and thus describe from that center to the point of tool, a radius equal to that of smoke arch it is desired the saddle to fit.



CIRCULAR PLANING ON CYLINDER SADDLES.

The opposite saddle being left free to move, is connected to the swivelling tool head by means of a bar, and on motion being given to the latter, the cutting tool describes an arc of correct radius if the tool is of proper length out of the clamps, this point, of course, being decided by measurement. This method of fitting cylinders to arches is pronounced a good thing for two reasons; one is the quality of the job when completed, and the other is cheapness of labor cost. To those who have banged away at a chisel for a couple of days, working "double header," that is, a man on each side, and a board screen between as a back stop for the flying chips, this scheme looks as though there was something in it.

The New York Railroad Club.

The paper entitled "Fads, Customs and Their Costs," presented to the club by its author, Mr. R. P. C. Sanderson, at the December meeting, will be memorable as one that stirred up the members to as warm a discussion as any in the history of the club. Everybody seemed to have their war paint on, to repel the attacks on their individual fads, and so vigorous was the fight that the author, though known to be fertile of resource and not addicted to "bad breaks," was kept busy in trying to sustain the positions taken in his paper, honestly made, no doubt, but open to criticism, and this the paper received without mercy.

Cast stacks of 520 pounds, at $3 to $4 each, furnished an opening for some adverse comments on foundry practice, where a casting for a stack could be made for 0.6 cent a pound. When the extension-front item was reached, Mr. Rufus Hill, the inventor of the original extension front, gave an interesting and amusing history of the working of his device, affording a rare treat to the members, in the opporunity to hear from the lips of the inventor the reasons for his development of the well-known device. In connection with the retaining of cinders in the extension front, a story was told of an electric-light plant whose boilers were run exclusively with refuse from extension fronts, and a visitor who was informed of the fact that the fuel was doing duty in a firebox for the second time, asked: "Where do you burn it next?"

The subject of pressed steel for freight cars was one that received the earnest attention of every car man present, and that part of it referring to trucks was pretty well perforated by the shafts of cold sarcastic fact resurrected for the occasion. The statement that a diamond truck of steel, suitable for a 30-ton car, could be built for $74.50 per truck, caused a spasm to some of those present who had vainly tried to get up such a truck at a figure in the vicinity of $100, and failed; but the author was strongly entrenched with figures to substantiate the price shown in type—600-pound wheels at 0.85 cent a pound, however, was looked upon as too thin a price for good wheels. Every part of the paper was treated to a searching inquiry, and those items not well buttressed were handled rough enough. From the way the champions flew to their rescue, it don't look as though fads received a serious set-back; but the paper was well written, and as well defended by its author.

Dallas, Texas, is the home of Mrs. C. W. Mead, who has attained the high eminence of inventing a car coupler. The local papers are enthusiastic about the great event. Mrs. Mead's invention, they say, has all the simplicity of the Janney coupler, and is really more effective, because it can be operated on sharp curves as easily as on a straight track. Mrs. Mead has spent twenty years on this work, and is greatly admired by her acquaintances because of the mechanical genius she has shown. We are gratified to find local opinion so favorable to the lady who has invented a car coupler; but we cannot help thinking that she would have been working more in her own line, if she had devoted her attention to improving the sewing machine, or in producing a cradle that rocked automatically.

A committee of the Railway Master Mechanics' Association, of which Mr. J. H. Manning, of Omaha, Neb., is chairman, has sent out a circular asking for information concerning boiler coverings. The association ought to be pretty well informed on this subject soon, for it has been reported on three times within the last few years.

The Brooks Locomotive Works completed, November 27th, the last of twenty locomotives built for the Lake Shore & Michigan Southern Railroad. This order was executed in remarkably quick time, the Brooks Company having booked the order October 2d and begun shipping November 5th, since which date they have delivered to the railroad company at the rate of seven a week. Foreign exchanges please note.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

The Effect of Brake-Beam Hanging Upon Brake Efficiency.

BY R. A. PARKE.

After so many years of the use of brakes upon railroad trains, after such elaborate and costly experiments to secure high brake efficiency, it would appear strange if any important advance in the construction of brake gear upon cars were yet to be discovered.

Surrounded, as it is, by dynamical conditions which are in themselves very complicated, and which are only as yet partially understood, it is not altogether surprising that a systematic analysis of the design and action of brake gear has been neglected; but the complexities are not too great to permit a sufficiently satisfactory analysis to be made, and the prospective benefits to be derived from the information thereby obtained appear to reward the tiresome work which such an analysis has involved. That such an analysis has afforded the clue to such a simple modification of the present mode of suspending brake beams as will enable trains to be stopped thereby in from 10 to 15 per cent. shorter distance, sufficiently attests the value of attacking dynamical problems through the methods of theoretical mechanics.

Let us suppose a box of merchandise, in the form of a perfect cube, each edge of which is 12 inches long, to be dropped upon the parallel platform from the open door of the rapidly moving train. Immediately after the box comes into contact with the platform, it will, in all probability, roll over and over a number of times before finally coming to rest upon the platform. The reason for this is quite evident. The center of gravity of the box is 6 inches from each face of the box, while the frictional resistance between the platform and the box is at its lowermost surface, and is, therefore, an eccentric force. This frictional force tends both to stop the motion of the box and bring it to rest (a retarded motion of translation), and also to cause the box to turn end over end (a motion of rotation).

Now, instead of being a perfect cube, let it be supposed that this box is 12 inches long and 12 inches wide, but only 2 inches high, so that the center of gravity is only 1 inch from the top or bottom face of the box. Let this box be dropped from the moving train so that it strikes upon the platform upon its bottom surface. It is now quite likely that the box will simply slide along upon the platform until it comes to rest, without the production of any rotation. It must not for a moment be supposed that, because this box has merely slid along the platform without rotation, there has been no *tendency* for the box to rotate.

If, as it slides along upon the platform, the box should encounter an uplifted end of a warped plank, so that a new and greater retarding force than the mere friction of sliding becomes interposed, it is most probable that the box, thin as it is, will now rise up at the rear end and rotate about the forward edge, turning over at least once.

Again, let us suppose a box 2 feet square and 6 feet high to be loaded with pig iron and to be standing upon one end. One man pushes against the box in an endeavor to overturn it. Nothing results. A second man assists in pushing against the box, but with a like result. A third, a fourth and a fifth man successively lends his additional aid in pushing against the box, but with no better result. A sixth man, however, in lending his aid to the other five, enables the box to be overturned. The sixth man did not overturn the box. Each man contributed a certain force which had a tendency to overturn the box, and, when only one man pushed against the box, he produced a tendency to overturn it. As, man by man, he received more aid, the pressure of the box upon the earth was more and more transferred to the edge farthest from the men until, finally, when the sixth man arrived, the weight of the box was entirely transferred to the farthermost edge and the box was overturned.

This leads us to the situation to be considered whenever the brakes are applied to the wheels of a moving car, though, to fully appreciate this fact, we must first understand what results from applying brakes. The stopping of the car is only what *indirectly* results.

To more fully appreciate this statement, let us consider, for simplicity, a single moving car which, by some means or other, has been set in motion, but which, at the time of our consideration, is moving alone and unattached to any other vehicles. If, while the car is moving upon the railroad track, the brakes are applied, the car will soon come to a stop. But let us suppose that, by means of a balloon, the car, while still in motion, is, in its entirety, lifted up from the rails before the brakes are applied, so that the wheels are no longer in contact with them. The car is still moving with the same speed that it had before the balloon lifted it and, as the wheels were rotating at their customary speed, through contact with the rails, before the car was lifted from the rails, they still continue rotating as they did when the car rested upon the track. If we now apply the brakes, we can readily understand that what happens is that the rotation of the wheels will be quickly stopped through the friction of the brake shoes upon them; but the car, with its trucks and wheels, will continue to move along at the same speed that it did before the brakes were applied. In other words, the only effect of applying the brakes has been to stop the rotation of the wheels. Plainly, therefore, the effect of applying the brakes to the wheels of the car is not directly the means of stopping the motion of the car; the mere stopping of the rotation of the wheels has nothing to do with altering the speed of the car, if no other forces are thereby introduced than would occur under the supposition that the car is not in contact with the rails. We also perceive that the only direct function of the brakes, as applied to the wheels of the car, is to check their tendency to continued rotation. This then, and this only, is the immediate effect of applying the brakes to the wheels of the car.

The instant that any tendency toward sliding of the wheel upon the rail occurs, the frictional resistance, due to the pressure of the wheel upon the rail, immediately asserts itself, and causes the wheels to persist in their rotation, notwithstanding the fact that the brake shoes, in rubbing upon the wheels, offer a resistance to their continued rotation. It should be plain, therefore, that what actually retards the motion of the car is the frictional resistance, or backward force, of the rail upon each wheel.

The tendency of the frictional resistance applied by the rails to the wheels, when the brakes are applied, is to overturn the car body about an axis of rotation which is situated at the center plate upon the forward truck, and also to overturn each truck about an axis of rotation situated at the point of contact between the forward pair of wheels and the rails. The car body does not actually overturn, neither does either truck overturn, for the simple reason that the forces tending to overturn them are insufficient. It is not difficult to conceive, however, that, if the car wheels were provided with teeth, which were very strong, and that the rails consisted of racks, with correspondingly strong teeth, and that the brake shoes were also racks which could be suddenly forced into the teeth of the wheels, the rotation of the wheels would be instantly stopped by an application of the brakes, and both the car and the trucks might actually tumble end over end.

Fig. 1 represents the body of a car in

* Extract from a paper read before the November meeting of the New York Railroad Club.

motion, where the brake beams are suspended from the trucks. By introducing the forces which are applied to the car body by all external objects with which it is in contact, we have all the conditions of a free body, the motion of which may now be conveniently studied. Each of the forces is represented by an arrow, as is also the direction of motion of the car. There are, or may be, six different forces directly applied to the car body by connected objects, during an application of the brakes. They are, respectively, a forward pull upon the draw bar at the forward end of the car, represented by D_1;

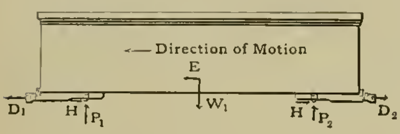


Fig. 1.

a backward pull (which may also be a forward push) upon the draw bar at the rear end of the car, designated by D_2; an upward supporting pressure P_1 from the forward truck, at the forward center plate, which is, of course, equal to the portion of weight of the body supported by that truck; an upward supporting pressure P_2 from the rear truck, which is likewise equal to the portion of the weight of the car body carried upon that truck. The two additional forces applied directly to the car body by external bodies are those marked H, each being a horizontal retarding force applied respectively by the forward and rear trucks at the forward and rear center plates. The two forces H will be regarded as invariably equal, during an application of the brakes, for the reason that the retarding forces resulting from the application of the brakes to the two trucks should always be equal. In addition to the forces directly applied by other bodies which are, or may be, in contact with the car body, there is always the additional force of gravitation, or what we customarily designate as the weight of the car body, represented by W_1.

Another force, acting through the center of gravity of the car body, is designated by E. It is with this force that we have chiefly to deal in considering the difference in the magnitude of the forces P_1 and P_2. When the brakes are applied, and the two forces H are thereby applied by the trucks to the car body, the imaginary force E is immediately called into existence, whereby, through what we call inertia, the car body tends to continue its movement in spite of the resisting forces applied to it.

In Fig. 1, it is seen that all the retarding forces are applied to the car body at a point considerably below its center of gravity. The resultant of this system of retarding forces must be equal, and opposite in direction, to the force E, and. being applied below the center of gravity of the car body, it is an eccentric force resisting the forward motion of the car body. It, therefore, tends both to cause a retardation of the motion of the car body and to cause the car body to rotate about the forward center plate, at P_1. The result is that the portion of weight carried upon the rear truck is diminished, and, as the weight of the car body must be carried by the two trucks, there is a corresponding increase in the weight carried upon the forward truck.

Such being the fact, it is unquestionable that a less pressure of the brake shoes must be exerted upon the wheels of the rear truck than could be exerted upon the corresponding wheels of the forward truck, to prevent wheel sliding at the rear truck. The greatest brake shoe pressure which can be applied to the wheels, without causing them to slide upon the rails, is thus limited by the pressure of the wheels of the rear truck upon the rails, and no further consideration whatsoever need be given to the forward truck. What we have now to consider alone are the conditions existing upon the rear truck.

Fig. 2 represents the rear truck of the car under consideration. Here again it will be seen, as in the case of the car body,

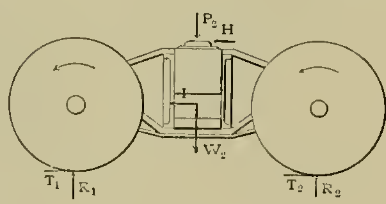


Fig. 2.

that the forces T_1 and T_2, resisting the forward motion of the truck, are applied at the lowermost points of the structure, while the forces urging the truck forward are, first, the force I, due to inertia, applied at the center of gravity of the truck, and, second, the force H, applied at the center plate, far above the center of gravity. This condition inevitably results in a reduction of the normal pressure of the rear pair of wheels upon the rails, and in a corresponding increase in the pressure of the forward pair of wheels upon the rails.

We finally reach the primary object of this discussion, which, briefly stated, is a realization of the facts that, during any application of the brakes, the rear truck carries the least weight, and, in any case where the brake beams are suspended from the truck, the rear pair of wheels of the rear truck exerts a less pressure upon the rails than any other pair of wheels upon the car. If this fact is now clearly understood, it will be equally clear that, in order to prevent wheel sliding, a uniform brake shoe pressure upon each pair of wheels must be limited to what is safe upon the rear pair of wheels of the rear truck.

It is not uninteresting, however, to know that the correctness of these conclusions has long ago been demonstrated by Mr. P. H. Dudley, through actual experiment. In 1876, Mr. Dudley placed a passenger car upon a track scale in such a manner that three of the four pairs of wheels rested upon solid ground, while the rear pair of wheels rested upon the scale. The pressure of the fourth pair of wheels upon the scale was weighed, and then, the brakes upon the car having been fully applied by hand, a locomotive was attached to the forward end of the car, and the pressure of the rear pair of wheels upon the scale was again weighed. The results of these weighings, together with an approximate measure of the force of the pull upon the car by the locomotive, and such other data as was at the time obtained by measurement, demonstrate that the removal of weight from the rear pair of wheels was what should be expected. The car was then moved backward, so that only the forward pair of wheels of the rear truck rested upon the scale, the balance of the wheels resting upon solid ground. The pressure of the forward pair of wheels upon the scale was then weighed, and, after the brakes were applied, the locomotive exerted a forward pull upon the car, and the pressure of the wheels upon the scale was again weighed. This experiment demonstrated that the weight which was removed from the rear pair of wheels was correspondingly transferred to the forward pair of wheels, and, as nearly as could be determined by the irregular forward pull by the locomotive upon the draw-bar, the results were such as to fully confirm our conclusions.

It is a clearly established fact, therefore, that the customary method of organizing brake gear so that the same pressure of the brake shoes shall be applied to each pair of wheels, necessitates the reduction of that brake shoe pressure to within the safe limit for the rear pair of wheels. Certain apparent inconsistencies in air-brake practice may be explained in part through this condition of things. Such seeming

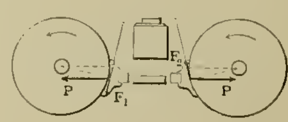


Fig. 3.

inconsistencies include the fact that it has been customary in the past to use a calculated braking power of only 70 per cent. of the weight of freight cars, while the custom has been to use a calculated braking power of 90 per cent. upon passenger cars. It will now be understood that a greater reduction in the portion of car body weight carried by the rear truck occurs with short freight cars than with long passenger cars. It will also be understood that a greater transfer of weight from the rear pair to the forward pair of wheels occurs with the short wheel base of freight car trucks than occurs with the longer wheel base of passenger car trucks. These two facts combine to reduce the safe brake shoe pressure upon freight car wheels more in proportion than upon passenger car wheels. It is true that other important influences bear upon this question, and these other features may profitably be considered.

A careful investigation has revealed the fact that, by a proper inclination of the brake-beam hangers, the brake shoe pres-

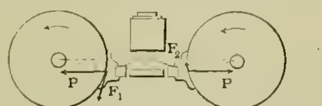


Fig. 4.

sure upon each pair of wheels may be fairly proportioned to the pressure of that pair of wheels upon the rails.

It is manifest that the rear pair of wheels, when the car is moving in one direction, becomes the forward pair of wheels when the car is moving in the other direction. It is, therefore, absolutely essential that any successful method employed for increasing the brake shoe pressure upon a pair of wheels when the car is moving in one direction, must decrease the brake shoe pressure upon that pair of wheels when the car is moving in the other direction. This is precisely what results from a proper inclination of the brake-beam hangers.

Fig. 3 represents diagrammatically the action of the brakes upon each pair of wheels of a truck when the brake hangers have the direction of the tangent to the wheel at the center of the brake shoe. The same pull P is applied to each brake beam. The brake shoes apply a downward frictional force F_1 to the forward pair of wheels, and an upward frictional force F_2 to the rear pair of wheels. The center of the brake shoe is shown to be at the intersection of these forces upon each pair of wheels, and lines representing the brake hangers are drawn tangent to the wheels at those points. It must be observed that, with whatever force F_1 the brake shoes act downwardly upon the surface of the forward pair of wheels, the wheels react upwardly upon the brake shoes, and this upward force is directly resisted by the brake hangers. There is thus a direct compression in the forward brake hangers equal to the frictional force F_1. In a similar manner, it will readily be understood that the rear brake hangers are subjected to a tension which is equal to the frictional force F_2.

Let us now consider an exaggerated case of inclination of the brake hangers, such as is shown in Fig. 4. Each brake beam is here subjected to the same pull P as in Fig. 3; but the frictional forces of the brake shoes upon the two pairs of wheels are no longer equal, as they were in Fig. 3. Let us first consider the forward pair of wheels of Fig. 4. When the brake shoes have been brought into contact with the forward pair of wheels, the combination is something similar to a toggle joint. The reacting upward friction of the wheels upon the brake shoes strongly tends to carry the brake shoes upwardly, along with the surface of the wheels, and, on account of the nearly horizontal position of the hangers, there is a strong tendency to force the forward pair of wheels away from the center of the truck. This tendency is, of course, resisted by the truck frame, and thereby a powerful pressure occurs between the brake shoes and the wheels, in addition to that pressure resulting from the pull P upon the brake beam. In this way, the brake shoe friction F_1 upon the forward pair of wheels of Fig. 4 is materially greater than is the case in Fig. 3, where the angle of the hanger is such that it exerts no influence to force the brake shoes against the wheels.

The effect of the inclination of the hangers upon the friction of the rear pair of

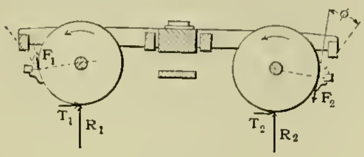


Fig. 5.

wheels of Fig. 4, is precisely the reverse of what it is in the case of the forward pair of wheels. The reacting downward friction of the wheels upon the rear brake shoes has a strong tendency to carry the brake beam downward, which, with such an inclination of the brake hangers, would swing the brake shoes away from the wheels. The effect of the pull P upon the brake beam is thus in part offset by the opposing tendency to draw the brake shoes away from the wheels, and a much diminished frictional action of the brake shoes upon the rear pair of wheels results. It is only further necessary to point out the fact that if the angle of inclination of the hangers were great enough, the friction F_2 upon the rear pair of wheels might be reduced to practically zero, while the mere initial contact between the brake shoes and the forward pair of wheels would then result in almost instantly creating such a high frictional force F_1 as to lock the wheels and cause them to slide upon the rails.

It is thus seen that if the brake hangers are so adjusted that they have the same angular direction as the tangent drawn to the wheel at the center of the brake shoe, as in Fig. 3, the frictional resistance offered by the brake shoes to the rotation of the wheels will be the same upon each pair of wheels. If, however, the brake hangers be sufficiently inclined to the tangent at the center of the brake shoe, the frictional resistance of the brake shoes to the rotation of the forward pair of wheels will be very greatly increased, while the resistance to the rotation of the rear wheels will be merely nominal. It is not difficult to conceive that if the hanger be given a less inclination to the tangent, the increase of the brake shoe pressure upon the forward pair of wheels and the reduction of the pressure upon the rear pair of wheels will not be so great; or, going one step further, that we may, by selecting a suitable angle of inclination of the brake hangers, proportion the frictional forces F_1 and F_2 in almost any way desired. If, therefore, we can ascertain the extent to which the forward pair of wheels of the rear truck presses more heavily upon the rails in an emergency application of the brakes, than does the rear pair, we may be able to determine such an angle of the brake hangers that the brake shoe pressure upon the forward pair of wheels shall be correspondingly greater than that upon the rear wheels.

It will be observed that, if, in Fig. 4, the wheels rotate in the opposite direction, through motion of the car in the opposite direction, what has been considered the rear pair of wheels will now become the forward pair. At the same time, also, the effect of the inclined hangers upon the two pairs of wheels has been reversed, so that it is still, under the changed conditions, the leading pair of wheels which is subjected to the greatest brake shoe pressure, and the rear pair of wheels which is subjected to the reduced pressure. Here, then, is a method of the utmost simplicity which fulfills the requirements of the case.

It will be interesting to discover the effect of the inclination of the brake hangers where the brakes are suspended

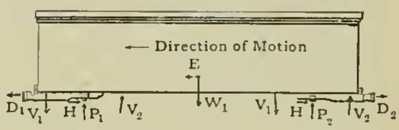


Fig. 6.

from the trucks, but outside of the wheels instead of between them. Fig. 5 will serve to illustrate such a case.

As heretofore shown, the application of the brakes results in an increased pressure R_1 between the forward wheels and the rails, and a decreased pressure R_2 between the rear wheels and the rails, whereby an increased rail friction T_1 might be utilized at the forward pair of wheels. An angle ϕ is shown to exist between the directions of the brake hanger and the tangent at the center of the shoe, which causes the brake shoe pressure to be increased upon the rear pair of wheels, and to be diminished upon the forward pair of wheels. This is precisely the reverse of what is desired. If the desired result is to be effected through an inclination of the brake hanger, it is quite evident that, where the brake beams are hung outside of the wheels, the hanger must incline inwardly instead of outwardly, which is, of course, out of the question, for constructive reasons. The wheel, itself, stands in the way of inclining the hanger inwardly, and this alone is a sufficient impediment to the application of the principle in cases where the brake beams are suspended from the trucks, but outside of the wheels.

As a foremost consideration, therefore, it is necessary, in order to realize the advantage of the principle of inclined brake

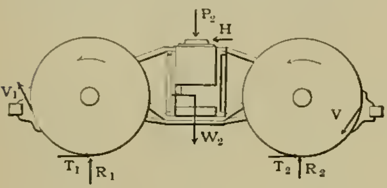


Fig. 7.

hangers, that the brakes shall be inside hung. It has been the practically universal custom to suspend the brake beams of passenger trucks outside of the wheels. This is radically wrong if proper efficiency of the brakes is desired. There seems to be little objection to hanging passenger brakes between the wheels. There appear to be many advantages in doing so. The objection, if any, would appear to be a somewhat less accessibility; and this objection appears to be of small significance in comparison with the advantages. The most important advantage is that the brake shoe pressure upon the different pairs of wheels may be so proportioned that, in an emergency application of the brakes, trains may be stopped in from 10 to 15 per cent. shorter distance, without any increased liability of injurious wheel sliding. This advantage is, of itself, so important as to overshadow all objections.

By hanging the brakes between the wheels, the hangers of the rear beam pull downwardly, while the hangers of the forward brake beam push upwardly, thereby tending to diminish the tilting of the truck, instead of aggravating it, as in the case of outside hung brakes.

Still another most excellent feature of inclining the brake hangers is the fact that the weight of the brake beams and attached parts thereby tends to swing the brake shoes away from the wheels, after release of the brakes, and gravity thus accomplishes what ordinarily requires the use of brake-beam release springs.

Nothing has, as yet, been said with respect to outside hung brakes which are suspended from the car body. An investigation of the conditions prevailing when brakes are thus hung from the car body, emphasizes the undesirability of this form of brake gear, and only brief consideration need be given it.

Fig. 6 diagrammatically represents a car body with brakes hung therefrom, and indicates all the forces which are impressed upon it during an application of the brakes. It will be observed that, in addition to all the forces applied to a car body when the brakes are suspended from the truck, as shown in Fig. 1, there are four new forces to be considered, namely, those applied by the hangers of each brake beam. The downward pull of the brake hangers from the forward brake beam of each truck is represented by V_1, and the upward thrust of the hangers of the rear brake beam of each truck is represented by V_2.

Let us now consider the extent of the tendency of the car to overturn about the forward center plate during an application of the brakes. As in the case illustrated in Fig. 1, the effect of inertia operates as a force acting through the center of gravity of the car body, at a considerable distance above the center plate, and there is, in this respect, the same tendency to cause rotation about the forward center plate as was found to exist in the case of Fig. 1. In addition, however, we here find the downward force V_1 from the forward truck acting with a considerable leverage to pull the forward end of the car body downward, and the upward force V_2 of the forward truck acting with a considerable leverage to lift the rear end of

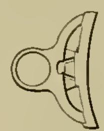


Fig. 8.

the car body. The downward force V_1 from the forward brake beam of the rear truck acts with a much greater leverage than that of the front truck forces, to restrain an upward motion of the rear end of the car body; but the upward force V_2 from the rear brake beam of the rear truck acts with a still much increased leverage to lift the rear end of the car body. It will thus be manifest that the transfer of car body weight from the rear to the forward truck, in an application of the brakes, is much more considerable in this case than in that where the brake beams are not suspended from the car body. Somewhat anticipating what follows, it may be well to here note that if the upward force V_2 from the rear brake beam should exceed the downward force V_1 from the forward brake beam, the transfer of weight from the rear to the forward truck will be still further aggravated.

It is interesting now to consider the effect upon the truck of suspending brakes from the car body. In Fig. 7 there are all the forces which were found, in considering Fig. 2, to be applied to the new truck with inside hung brakes. In addition, however, we find the two new forces V_1 and V_2, applied to the truck through the hangers of the forward and rear brake beams, respectively. In other words, the brake shoe friction acts upwardly upon the forward pair of wheels, but does not cause an equal and opposite downward pull upon the truck frame, as in the case where brakes are hung from the truck; and the downward frictional force of the brake shoes upon the rear pair of wheels does not cause an equal and opposite upward thrust upon the truck frame. These are therefore additional forces applied to the truck by the car body, and have an influence upon the tendency of the truck to overturn.

Now let us consider the tendency of the truck to overturn. The truck is dragged forward by the car body with a force H, and is impelled forward by a force I, due to inertia, against the resistances T_1 and T_2 at the rails. The action of these two forces H and I, with their respective leverages, tends to overturn the truck about the lowermost point of the forward pair of wheels. But, in addition to the opposition exerted by the forces W_2 and P_2 (respectively, the weight of the truck and a portion of the weight of the car body) to an overturning of the truck in a forward direction, the upward force V_1, acting with a moderate leverage, and the downward force V_2, acting with a very considerable leverage, may completely neutralize any tendency of the truck to overturn upon the forward wheels. This action of the forces V_1 and V_2 may be conceived to even more than balance the action of the forces H and I, and to thus have a lifting tendency upon the forward pair of wheels, which will decrease the weight carried to the rails, and simultaneously increase the weight carried to the rails by the rear pair of wheels. A careful investigation of the conditions reveals the fact that this is what actually does occur in practice; that is, if the same brake shoe pressure be applied to both pairs of wheels, the forward pair is the one that will most easily slide upon the rails, instead of the rear pair, as is the case where brakes are hung from the trucks. It will

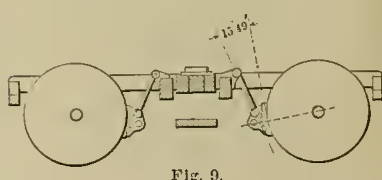


Fig. 9.

therefore be evident, that it is desirable to reduce the brake shoe pressure upon the forward pair of wheels, and to increase the brake shoe pressure upon the rear pair of wheels, in order to obtain the greatest efficiency with the least danger of wheel sliding. In other words, here is a case of outside hung brakes in which it is advantageous to incline the direction of the brake hangers outwardly from the tangent.

In designing brakes with inclined hangers, therefore, it is of the utmost importance that the brake hangers should be as long as possible. For this reason it is important to use brake heads of such a construction that the lower end of the hanger shall be as near the center of the brake shoe as possible. Fig. 8 will serve as an illustration of this most desirable feature. Those forms of brake head in which the lower end of the hanger is secured at a considerable distance above the center of the brake shoe, are least to be desired.

Fig. 9 illustrates the application of inside brakes with inclined hangers to a Canadian Pacific passenger truck. In this

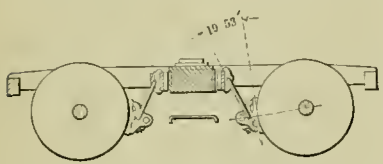


Fig. 10.

case, the angle of inclination, when shoes and wheels are new, is 15° 49′, and the length of the brake hanger is 18 inches, the form of brake head shown being necessary on account of the position of the equalizer spring seat. The calculated braking force is about 95 per cent. of the weight of the car, and the total maximum friction of the brake shoes in an emergency application is about 22.9 per cent. of the weight of the car. The stopping efficiency is theoretically about 10 per cent. greater than if the brakes had been hung in the ordinary way. A train of Canadian Pacific cars, with this truck brake equipment, was tested upon the main line of the road near Montreal. The day was a fair one and the rails in average condition. The stops were made with the high braking power upon a portion of the cars, and a braking power of 90 per cent. upon others. The wheels of the cars with high braking power slid during the last ten or fifteen feet of each emergency stop, and the wheels of the cars having the 90 per cent. braking power slid through about half this distance. All present were so much impressed with the unusual effectiveness of the brakes, and one or two stops were made from estimated speeds and the distance measured. Making ample allowance for errors in judgment as to speed, the stops made appeared to be about 15 per cent. shorter than any recorded passenger train stops from similar speeds.

Fig. 10 illustrates the application of inside hung brakes to the standard passenger truck of the Pennsylvania Railroad, the angle of the hanger being 19° 53′ when the shoe and 36-inch chilled iron wheel are new. The calculated braking power is about 95 per cent. of the weight of the car, and the total maximum brake shoe friction in an emergency application of the brakes, is 23.3 per cent. of the weight of the car. The stopping efficiency of this brake gear is about 11 per cent. greater than if the brakes were applied in the ordinary way.

Fig. 11 illustrates the standard passenger truck of the Erie Railroad. The length of the brake hanger is 24 inches, and the angle of inclination is 20° 24′ when the brake shoes and 36-inch steel tired wheels are new. The braking power is about 97 per cent. of the weight of the car, and the total maximum friction of the brake shoes is 23.2 per cent. of the weight of the car. The increased stopping efficiency of this brake gear is about 13 per cent. greater than would be the case if the brakes were hung in the ordinary manner.

It may be said in conclusion, that there appears to be no reasonable doubt that high efficiency of brakes can only be attained by suspending the brake beams from the truck frame and between the wheels. It is rarely a difficult matter to so suspend the brake beams of four-wheeled passenger trucks that the stopping efficiency of the brakes will be at least 10 per cent. greater, and so that trains may be stopped in approximately 10 per cent. shorter distance, than if the brake beams are hung in the customary manner. It may be questioned whether a considerable proportion of the freight trucks in service have a sufficiently long wheel base to enable the full advantage of inclining the brake hangers to be realized. Where the wheel base is short, it is impossible

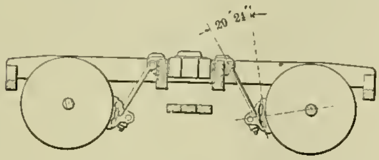


Fig. 11.

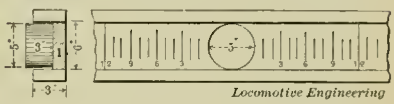
to make use of sufficiently long hangers at a sufficient inclination, and it is preferable to use longer hangers with a less inclination.

The Slideometer.

The "Doctor Standard" article in October number has called forth numerous inquiries regarding the Burlington brake trials. A number of these inquiries pertain directly to the Slideometer and the bearing this instrument had in the tests. The acompanying sketch, with the description of the instrument, taken from the record of the tests, will serve to make this feature better understood. We quote from the official record as follows: "At an early stage of the tests, the unlooked-for shocks in the rear car made it evident to the committee that an exceedingly important element in a long train contest was not provided with any registering device. The want of such a device became all the more apparent with the 50-car trains, which, it has been estimated, increased the violence of any particular shock in a greater ratio than the square of the number of cars added."

"The sliding movement of some of the tool boxes and loads during the earlier stops suggested to the referee the impact gage, or 'Slideometer,' as it was immediately named. On the ninth morning of the tests the Slideometer was first used, and its records at once became one of the most important during the contest.

"The device consists of a wooden trough 14 feet long by 6 inches wide, made of clear white pine, smoothly planed. In the trough slides in either direction a wrought iron weight 5 inches in diameter and 3 inches high, weighing 16½ pounds. Crude as the device may appear, it has answered its purpose perfectly, registering all the various demands made by the competitors. Whether a violent shock forward of from 50 to 150 inches, a jerk backwards, or a succession of rapid forward and back movements, the Slideometer always told the story, and doubtless met the different



THE SLIDEOMETER.

demands on it much better than more elaborate devices which might have been prepared, could the importance of some such gage have been foreseen. Its simplicity adds to its value, as it can readily be reproduced in any locality for testing purposes, or drilling men in handling long trains, etc.

"Shocks in ordinary handling of trains with slack couplings over sags, hog backs and working in yards, will move the disk from two to eight inches. Twelve inches has been estimated as sufficient to be injurious to live stock and equipment. Repeated blows of 12 to 20 inches in the mixed and loaded car tests were sufficient to start the loads at the rear of the train through the end of the cars; the loaded cars, thus, through the movement of the loads, becoming a check in weighing the length of the slideometer movement that was admissible and inadmissible."

Book for Air Pump Repairmen.

The most useful and complete treatise on air pumps is, beyond a doubt, a paper on "Air Pumps, Their Troubles and Treatment, and Tools For Making Repairs," which appears on pages 20-55 of the Air Brake Men's Proceedings. The committee that compiled the report is perhaps the strongest aggregation of air pump men that could be gotten together. Every air pump repairman should have a copy of the book. Paper, 50c. Leather, 75c.

The Southern Pacific shops, at Portland, Ore., are reported to be more busy with work than they have been since the depression of business commenced, four years ago.

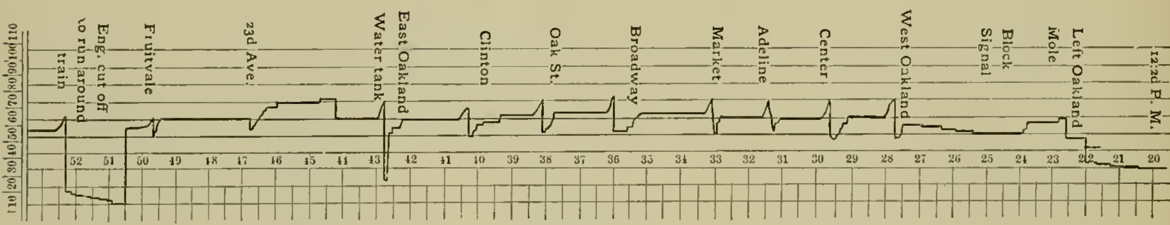
Another Pressure Recorder Card.

Mr. H. C. Frazer sends us another pressure recorder card, which we publish herewith.

This card is different in several respects from the one which appeared in this department last month. The travel has been increased to twenty-four inches per hour, and now plainly records numerous successive applications and releases; the failure to do this successfully having been the most serious drawback to the recorder heretofore, as a device of real value. The release of brakes was made, with few exceptions, in the full release position, and brake valve handle was then returned to running position.

The feed valve attachment does not seem to be working properly, as is shown by the variation of the pressure lines bebeween Center St., Adeline, Market and Broadway, etc.

The most noticeable feature of the card is the emergency stop at the water tank at East Oakland. Another feature almost equally interesting, is where, at 12.44, the brake valve handle was placed in full release position, where it remained about a half a minute, then was returned to running position. The pressure in the train pipe and auxillaries had equalized higher than the feed valve was set for. The train pipe was tight, however, as is shown by the pressure line. Had it leaked, the brakes would have set with the brake valve handle in running position. The record of this card is not as good as that one published last month, so far as skillful brake operation is concerned, but is a valuable card in showing up the low pressure carried, irregular operation of feed valve attachment, and the emergency application at the water tank.



ANOTHER PRESSURE RECORDER CARD OF AIR-BRAKE STOPS.

Mr. Frank Scheuerman, air brake instructor of the L. & N. R. R. at Mobile, Ala., was recently presented with a handsome gold watch and chain by the engineers, firemen, conductors and brakemen of the Mobile and Montgomery division. Mr. Scheuerman has always been a painstaking and conscientious instructor, and thoroughly deserves the honor his appreciative students see fit to confer upon him.

CORRESPONDENCE.

Increased Brake Cylinder Pressure in Quick Action.

Editors:

Early last April I made some practical tests to determine the amount of train-pipe air taken into the brake cylinder in an emergency application of the brake. Having been interested in the discussion of this question in your columns, I have recently repeated the tests, which, with the results, are as follows:

I screwed a test gage into the auxiliary of an 8-inch brake, and put another test gage in the oil plug hole in the cylinder. Then charged up so the three gages (including gage at brake valve) registered just 70 pounds. With a 7½-inch piston travel and a full service application, the pressures equalized at just 50 pounds. With a stop cock in the triple exhaust I reduced the cylinder pressure to 30 pounds, recharged the auxiliary to 70 pounds. The next full service application equalized the pressures at a shade over 60 pounds. Repeating as above with 29 pounds in brake cylinder, I got 60 pounds, and again with 28 pounds in cylinder I got a shade less than 60 pounds. This I repeated several times and got the same result each time. I do not believe that with true gages the contribution from the train pipe will show above 29 or under 28 pounds. I am convinced that this is just about right. However, it is as near as it can be reached with three good gages.

Another interesting point was brought out, as follows: I put a gage in the ½-inch hole in the bottom of the check-valve case on the quick-action triple. In an emergency application made with the brake valve, the hand on the gage would flash down to about 20 pounds, and then return quickly to about 40 pounds, and gradually rise to 45 or 48 pounds. It would seem from this that the brake cylinder gets its air from the volume in the close vicinity of the triple only, and the air coming from the more remote parts of train line again raises the pressure from 20 pounds up to 40 or 50 pounds, this depending on how much was reduced at the brake valve.

S. D. HUTCHINS.

Boston, Mass.

A Suggestion.

Editors:

In "Questions and Answers" in October issue, J. P., of Marshalltown, Ia., asks 1st. "Where does the trouble lie in the N. Y. Engineer's valve, plate No. 3, when it does not release; 2d. The same in D-8 Westinghouse valve."

I would advise him to make the following test: 1st. Put valve in running position. Pump up maximum pressure on engine and tender; 2d. Throw valve to full emergency, and let train line hand fall to zero; 3d. Place brake valve in full release position and watch the hands on gage. If the red or reservoir hand goes down to the black or train line hand, and both rise together, it indicates that the pipe from the main reservoir to the brake valve is stopped partly up. I have on several occasions found the trouble in the strainer, being choked up with cinders, pipe rust, moisture, etc., which is, as a rule, found in the first union from the brake valve.

In case the red pointer does not go down to the black one, as above described and the reverse takes place, it indicates that the pipe is clear. By noting the rapidity and the direction the pointers act, it will be easy to decide to what extent the pipe or passages are stopped up.

W. W. PITTS.

Hillsboro, Tex.

Prior Use of the Dust Guard.

Editors:

I see in your November issue cuts of an air brake dust guard. I would like to say that the same guard has been used on the private car "Texas," of General Manager Van Vleck, of the Atlantic system, Southern Pacific Railroad, for several months past. It is a very good and practical device, and has so proved itself.

J. C. FOWLER.

Beaumont, Tex.

Our question and answer column has been quite full of late. Let the questions keep coming. That shows that readers are interested, and that nobody is yet perfect. But don't ask us to answer questions by private correspondence. Life is too short.

Train Pipe Air In Quick Action.

Editors:

I have been interested in the writings of Mr. Willett, J. P. Kelley, and yourself in regard to the amount or pressure of air obtained in the brake cylinder by train line air entering it in emergency application, and have therefore made a few experiments to see if I could not find out for myself what it would be with an 8-inch cylinder and 8-inch travel.

I first applied the brake by a full service application, and obtained 50 pounds pressure in the cylinder. I then closed a stop cock which I have in the pipe from exhaust port of the triple to the pressure retaining valve on the tenth car of my plant, and released the brakes, or rather released them all except the tenth. I then opened the stop cock and let the cylinder pressure down to 35 pounds. When the auxiliary reservoir was again charged to 70 pounds I applied the brake with a full service application, or until the auxiliary reservoir and brake cylinder pressure on the tenth car equalized, and found the pressure to be 62 pounds. I then repeated the experiment with 30 pounds in the brake cylinder instead of 35 pounds, and it gave me just 60 pounds instead of 62 pounds in the brake cylinder. This led me to believe that the amount of air entering the brake cylinder from the train line in emergency application is such that would give a pressure of 30 pounds if allowed to fill the cylinder alone.

To determine the cubic inches of space this air would occupy if compressed to 60 pounds pressure, we would have a problem as follows: 30 pounds gage pressure, plus 14.7 atmospheric pressure, will give 44.7 absolute pressure. If we take the cubic inches of space in an 8-inch cylinder with 8-inch travel to be 450 cubic inches, which is probably as near as it can be figured, we must now multiply 450 by 44.7 and divide the product by 74.7, and we have 269 cubic inches as the space filled to 60 pounds pressure by the train line air entering the brake cylinder in emergency application.

E. G. Desoe,
A. B. & S. H. Inspector,
B. & A. R. R.

Springfield, Mass.

In reply to Orange Pound, who asks, in December number, why the new high speed brake could not be used on freight trains equally as advantageous as on passenger trains, Mr. [illegible] of Nashua, N. H., writes us that he fears the engineer might be tempted to apply and release too often, and thereby break the train in two. He believes this would be particularly true on partially equipped air brake trains, where the train men persist in using hand brakes on the rear end to hold out slack and keep the trains reached.

An Experience with a Leakage Groove.

Editors:

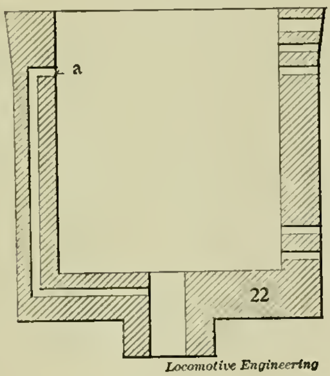
An engineer at this point found, by watching it going down the hills, that the tender brake on the engine he was running would not apply in service application with a train of 25 cars or more, but would apply all right with a short train or lone engine. The tender was equipped with a plain triple valve, a 10 x 24-inch auxiliary reservoir and an 8-inch brake cylinder. The triple valve and all working parts were in good condition. What was the cause?

Answer. The leakage groove in the brake cylinder was too large.

J. A. A.

Port Morris, N. J.

[This cylinder was one probably used with straight air, and the groove had been cut by someone not understanding the importance of having it the proper size. The size of this groove is carefully watched by the air brake manufacturer, who understands that it should be so large, and no larger.—Ed.]



WHAT IS THE FUNCTION OF PORT "A"?

Function of a Port.

Editors:

Please advise me as to the functions of the small port *a* in reversing cylinder No. 22 in 8-inch air pump, and state if same can have any influence on the pump not working. I have never seen any explanation relative to this port. C. B. B.'s question and B. J. M.'s in November issue of Locomotive Engineering, page 847, come as near to it as anything I have seen.

I attach sketch of cylinder to let you know to what I refer.

W. G. Ramsey.

Davenport, Iowa.

[The function of the port in question is to offer drainage to the top of the reversing piston, and also to allow the condensation to pass to the reversing piston stem where it serves as a water packing. No.—Ed.]

Test of Repaired Air Pump.

Editors:

It may be of interest to air brake machinists to know just what the 8-inch air pump will do after receiving general repairs. Also a time test of the pump made on the shop plant with low boiler pressure, and afterwards placed on the engine, and time test made in actual service. Below is given the average of some thirty pumps, from records which I have kept.

Boiler pressure, 95 pounds; pressure at pumps (90 feet from boiler with pipe unprotected), 84 to 87 pounds; average temperature, 66 degrees; capacity of reservoir, 20,000 cubic inches.

Compressed	to	25	pounds in	30	seconds.
"	"	41	" "	60	"
"	"	55	" "	90	"
"	"	66	" "	120	"
"	"	75	" "	150	"
"	"	81	" "	180	"
"	"	86	" "	210	"
"	"	90	" "	240	"

Now let us see what these pumps did when placed on the engines in actual service.

Average boiler pressure, 140 pounds; capacity of reservoirs (two), 11,000 cubic inches, each = 22,000; average temperature, 67 degrees; time of compressing, 0 to 90 pounds gage pressure, 3 minutes and 15 seconds; volume of free air compressed, from 0 to 90 pounds gage pressure as follows: 1 cubic foot of air at 90 pounds = 7.122 cubic feet of free air; 12.7 cubic feet of air at 90 pounds = 90.45 cubic feet of free air.

Hence, in 3 minutes and 15 seconds a volume of free air equal to 90.45 cubic feet was compressed from 0 to 90 pounds, and filled two main reservoirs, whose joint capacity was 12.7 cubic feet.

Ralph E. State,
"Big Four" Ry.

Bellefontaine O.

Recent investigation and experiment seem to indicate that broken graduating pins and weak graduating springs are much maligned and misrepresented parts of the brake system. One prominent air brake man states that in nearly every instance where trouble has been assigned to these parts he has been able to trace the real fault to the neglected and dirty condition of the triple. He says further, that cleaning and oiling the triple causes the trouble to disappear.

From experience acquired with the high speed brake, it has been decided to henceforth adjust engine and tender cylinder pressure reducing valves to 60 pounds, instead of 50 pounds, as was the former practice. This makes 60 pounds the uniform standard for engine, tender and car valves.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(1) F. R. H., Anderson, Ind., writes:

How long does it take to charge empty auxiliary with the triple valve that is known as the "Special" triple? I have heard that the time was shorter than the plain triple valve. A.—The older form of special triple valve charged quite slowly, requiring more than two minutes to charge from 0 to 70 pounds. In the later form, however, the groove is made so that the full charge may be had from 0 to 70 pounds in about one minute.

(2) R. D. C., East Tawas, Mich., writes:

In pumping up pressure, why is it that the red hand, representing main reservoir pressure, rises from 12 to 15 pounds in advance of train-line pressure, using D-5 valve with reducing valve attachment? A.—If the red hand keeps that amount ahead of the black hand at all times when train line and main reservoir pressures are in communication, it is set ahead that much on the pinion. If both hands more nearly approach each other as they go up, the trouble lies in the leverage of the gage, and may be corrected by adjusting those parts.

(3) A. E. K., Covington, Ky., asks:

1. What is the difference between the D-5, E-6 and F-6 engineers' brake valves, and why are they so named? 2. Is the D-8 valve the same as D-5? A.—1. The D-5, E-6 and F-6 valves are all the same, and have the feed valve attachment. The letters and figures by which they are commonly known merely refer to the plate in the catalogue. A.—2. The D-8 valve has the excess pressure valve, and therefore is not like the D-5. Air brake men in general, in order to avoid confusion when speaking and writing of the valves, have agreed to designate the D-8 as the 1890 valve, and the D-5, E-6 and F-6 as the 1892 model.

(4) B. J. S., Princeton, Ind., writes:

In reference to the question answered on page 848, I was referred by a good party to Forney's "Catechism on Steam Engines, etc.," where he says that a low-pressure cylinder is emptied quicker than a high-pressure cylinder. There would seem to be a conflict between your answer and this statement. Please explain. A.—Question 126, on page 848, and the one above stated are entirely different. If two cylinders of equal size and capacity be taken, one filled with steam or air at 150 pounds pressure, and the other at 50 pounds, and equal sized openings be made in both cylinders, the high-pressure cylinder will reduce from 150 to 140 quicker than the low pressure will reduce from 50 to 40. But if these openings be left open, the low-pressure cylinder will empty itself quicker than the high-pressure cylinder.

(5) B. J. L., Jackson, Miss., writes:

I have noticed that much stress is laid on the shock a train receives when brakes are applied on fifty cars, and that you say the shock is calculated by the slideometer. Please explain, and say whether the tests are made for shock or for shortest distance. A.—See description of the slideometer in another column of this department. When the several brake manufacturers met in Burlington nearly ten years ago to compete in the trials, their chief and almost sole aim was to make the shortest stop possible. They knew nothing of the shocks then, but soon learned that stopping with little or no shock was quite as important as stopping in a very short distance. The slideometer was first used there, and has played a very important part in all subsequent trials. The tests require both short stops and no shock.

(6) J. R. M., Philadelphia, Pa., writes:

In the W. A. B. Company's (1897) "F" catalog, the plates showing both the passenger and freight quick-action triples omit the graduating port through the slide valve. It would hardly seem that this important port could be left out. Possibly the failure to show the port is an error in the drawing. Please explain. A.—In the more recent form of triple valve, the graduating port through the slide valve has been given a sloping side direction, instead of the vertical, as in the older form. Hence, a vertical section of the slide valve, as shown in the plate, will not bisect the port as it did in the older plates. While the drawing in the "F" catalog shows that the slide valve is sectioned on a different plane from that bisecting the graduating port, it might have been made plainer, perhaps, by employing broken lines to show that the port extends through the slide valve.

(7) W. W. M., Bloomington, Ill., asks:

Should there be any space between the top end of main steam valve 7 and lower end of reversing piston 23 when the former has traveled downward till it strikes stop peg 50? A.—The stop pin is used only to prevent the main valve from dropping down out of place when steam is shut off, and should not be made of such length that the main valve will strike it when pump is running. When steam is on and the pump is running, the reversing piston stem touches the upper piston head of the main valve on both up and down strokes of the parts. But the length of the stop pin should be such as to give a little clearance when pump is running, and prevent it dropping out when steam is shut off. The length of the pin should be such that the distance from the top of the pin to the face of center piece will measure 25-64 inch.

(8) G. H. R., Chaplian, N. Y., writes:

I have had some trouble with feed valve attachment on D-5 brake valve. With handle in running position main reservoir and train line register same pressure at all times. Slackening off pressure spring in feed valve attachment has no effect when the bottom part of the feed valve is screwed up tight, but by slackening it down about 1-16 inch it works all right. When feed valve is screwed up tight piston is held to top post of valve body. Diaphragm gasket is squeezed out very thin on outer edges. Please say what is the proper way to remedy this defect? A.—The trouble is caused by the rubber diaphragm being squeezed thin at the edges, which allows the parts to be carried bodily upwards, and holds the feed valve off its seat at all times. A new rubber diaphragm will correct the trouble. The practice of removing the spring case from the valve body should be abandoned, as each time it is screwed up the gasket is made thinner at the edges, and finally the above trouble makes its appearance.

(9) B. J. S., Princeton, Ind., writes:

Suppose we take a cylinder, say, 10 inches diameter, 12 inches stroke, with an air tight piston, set at one end and no escape at the other, and full of natural air. If I push the piston down 6 inches, or half its stroke, there will be one atmosphere of pressure in the lower end of cylinder, and represents 471 cubic inches of air. If the piston is pushed 2 inches further, or two-thirds the stroke, we will have two atmospheres of pressure. Does this represent another 471 cubic inches, and if so does this ratio hold good to the end of the stroke? A.—When dealing with atmospheres we must always remember and consider absolute pressure. In other words there is a pressure of 14.7 pounds everywhere on the earth's surface, which does not show on the gage. When the gage shows 14.7 pounds pressure there is really a pressure of 29.4 pounds. This is called absolute pressure, and is atmospheric pressure (14.7 pounds) plus gage pressure (14.7 pounds), or two atmospheres. Boyle's Law states that with temperature constant, the pressure varies inversely as the volume, or if the volume be halved, the pressure will be doubled. If the pressure be doubled it will be found that the volume has been halved. This ratio holds in all cases. In the above example the 10 x 12-inch cylinder has 942.5 cubic inches, and the pressure is one atmosphere. If the piston be pushed in half stroke, or 6 inches, there will be absolute pressure of two atmospheres (29.7 pounds), or a gage pressure of 14.7. If the piston be pushed 3 inches further the volume will again be halved, and the pressure will again be doubled. This ratio will hold true to the end of the stroke.

(10) J. F. M., Waterloo, Ia., writes:

The question has come up among the enginemen why you can stop a nine car passenger train in much shorter space than you can a three car passenger train.

Speed of train, weight of car, piston travel, leverage and condition of rail equal. As I understand it theory says you can not, while practice says you can. Please advise through the columns of your paper. A.—If every pair of wheels under the engine, tender and all cars were braked to 90 per cent. of the weight resting on them, and all other conditions were equal and perfect, a three car train and a nine car train could be stopped in the same distance. The nine car train would, perhaps, run a little the farthest, owing to the difference in time of application between first and last car. This ideal condition, however, does not exist. The engine truck wheels are unbraked, the drivers are often braked low, and the tender brake is seldom as efficient as the car brakes. In other words, the train holds the engine and tender back. This can be proved by watching the coupling between rear of tender and first car. Three cars cannot hold back the engine and tender as well as nine cars can, and the long train will be stopped in a shorter distance than the short train. In the N. C. & St. L. Railway tests, which appear on page 209 of the Air Brake Men's 1895 Proceedings, a properly braked engine, tender and five day coaches were brought from a speed of 40 miles per hour to a standstill in 400 feet in 19 seconds. Four Pullman sleepers were added, making nine cars. At the same speed, 575 feet, and 25 seconds were required to make the stop. The Pullman brakes were not so efficient as the others, and the engine, tender and coaches therefore had to do a certain amount of holding for the deficient sleepers. If the engine and tender brakes are good, and the car brakes are poor, a short train will be stopped shorter than a long train. Conversely, if the car brakes are good and the engine and tender brakes poor, the long train will be stopped in the shortest distance. If the brakes are equally efficient on engine, tender and cars, the long and short train stops will be equal.

We still have a few copies of the Air Brake Men's 1897 proceedings left. Send for a copy. Don't wait until they are all gone, and then discover that your file is incomplete; 50 cents for paper bound, and 75 cents for leather bound.

The season for flat wheels is rapidly approaching, and in some instances is already with us. Keep the main reservoir drained, and use sand judiciously.

"Hanging room only," is certainly a happy and appropriate phrase as used by a correspondent to describe the neglected location so frequently given the air gage by modern slipshod practices.

"The World's Railway."

We find there is a very active demand for the "World's Rail Way," and among the many persons who have purchased this magnificent book, we have never found one who was disappointed with it. All who have written about the book have expressed themselves as being highly pleased with its artistic make-up and its interest as a history. We submit a few opinions of the press and of individuals.

Engineering News says: "The development of the railway and of the locomotive is followed out together in a most interesting and instructive manner, with much incidental matter as to historical events, the construction of lines of historic importance, modifications in locomotive design, and the development of track, rolling stock, etc. The illustrations form one of the most valuable features of the work, for though they are nearly all tinted reproductions of water-color drawings, they are very accurate, and are drawn with sufficient care and clearness to show the details of the exterior parts, even to the arrangement of valve gear in some of the foreign engines which have their gear outside the wheels. In showing the general style and peculiarities of the old engines and their general appearance, as compared with modern engines, this class of illustration is very successful; more so, in fact, than any number of general and detailed line drawings, since they show just what these engines look like in service, while the figure of the engineman on each locomotive gives at once a scale which enables the reader to realize the sizes of the engines."

The *Railway Age* says: "The work is necessarily a valuable compendium of the available information covering the historical period of the locomotive, and no pains or expense has been spared in presenting the matter in an attractive form."

The *Locomotive Firemen's Magazine* says: "Typographically this volume is a work of art, and, moreover, the author has presented to the reading public in its most attractive form the history of the locomotive from its inception."

Locomotive Engineers' Journal says: "It will make a valuable addition to the library of the student in the history and evolution of railroad appliances."

In a recent editorial notice the *Railway Review* says: "It should be in every library which makes any pretension to railway literature, and no man can read it without feeling an increased pride in his avocation."

"'The World's Rail Way' is a magnificent work and one that will prove of interest for all time to come."

"I obtained the 'World's Rail Way' through Mr. Moore, of London, and I must say that it is a splendid work and ought to be on the table of everyone interested in railway matters."

"I trust that other libraries will prove equally appreciative and take advantage of the opportunity to thus obtain a work that is exceptional and quite out of the ordinary run of book production."

"I am very well pleased with it. It is much better than I had expected."

"It fully carries out all your circular claims for it."

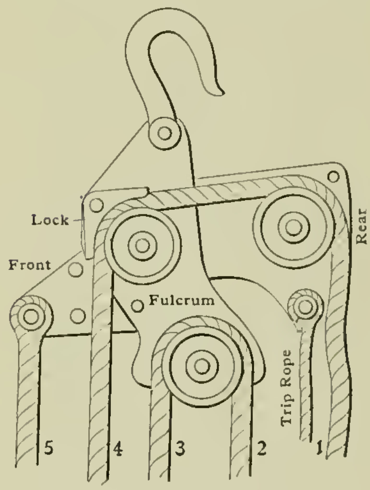
"It is a beautiful book and well worth twice the money."

The Burr Safety Hoist.

This kind of device is becoming more and more common in shops, as it is found that it does not pay to have men do back-breaking work when a hoist can do it better, and without danger of "Bill's letting her slip."

This is a rope hoist; has a lock block which enables a mechanic to hoist a piece with one hand, and leaves the other free to adjust the piece in the machine. This is something we believe has never been accomplished before in a rope hoist.

It will lock wet or greasy rope, and never cuts or wears the rope, as it will be seen the action is positive and that the lock is entirely away from the rope when



BURR SAFETY HOIST.

not needed. The cut shows the side plate removed and the lock gripped on the rope. By releasing the hoisting rope, the load pulls down the front arm of the lever, swings the sheave forward and clamps the rope against the lock, sustaining the load at any point desired. The heavier the load, the greater the pressure to hold the rope.

This is said to be a new principle in hoists, and the many testimonials from railroad and other machine shops speak very highly of it as a device which can be depended on when wanted.

The Burr Manufacturing Company, 823 Society for Savings Building, Cleveland, O., are the makers.

The Largest Locomotive in the World.

The very handsome engine shown on pages 52, 53 and 54, is one of two Mastodon twelve-wheel freight locomotives recently built by the Brooks Locomotive Works for the Great Northern Railway. We frequently hear it reported that 100-ton locomotives have been built for certain railroads, but somehow when the weight is critically examined the engine fails to come up to the 200,000 pounds mark by a good many thousand pounds. This latest production of the Brooks works, however, passes the 100-ton mark and is therefore the heaviest locomotive ever built. The weight in working order is 212,750 pounds, 172,000 pounds being on the drivers.

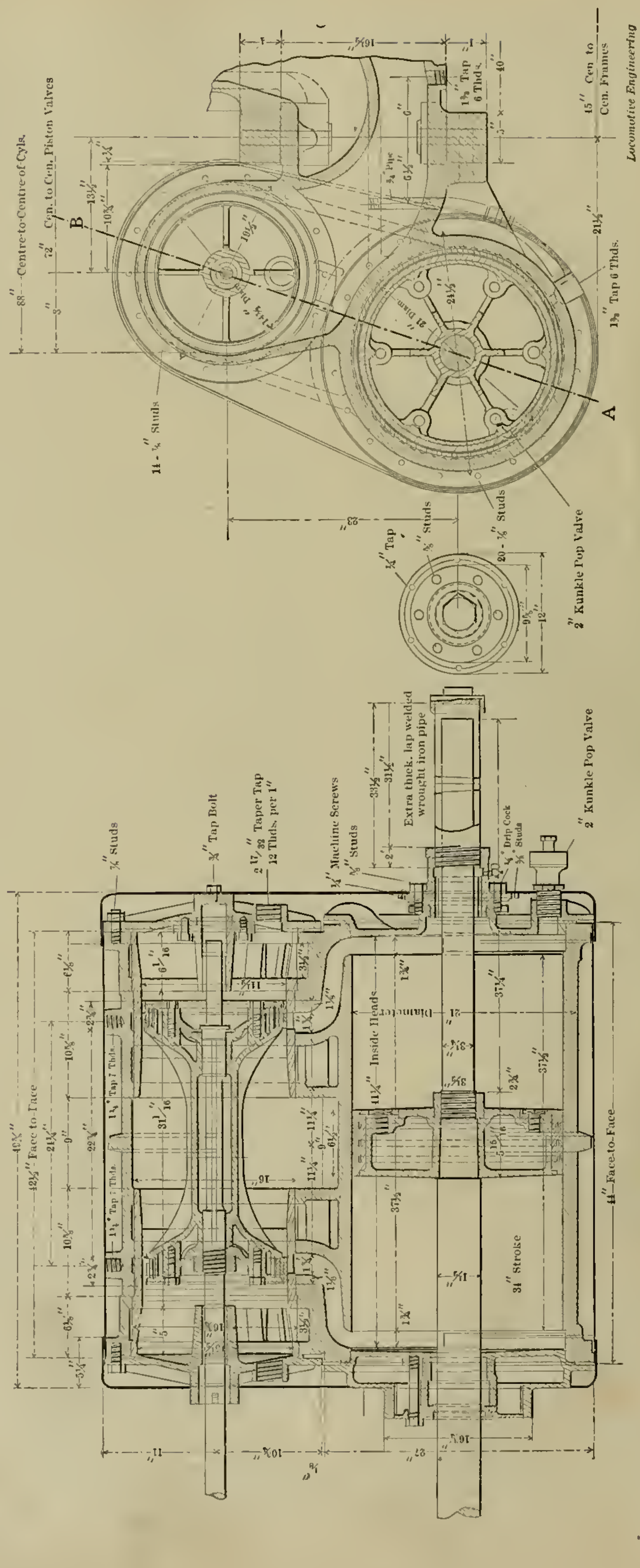
As the heaviest locomotive in the world this engine would deserve more than ordinary attention, but there are many peculiar features about this engine which display fertility in designing and are well worthy of careful study.

One of the first things that strikes a beholder is the symmetry in the design of these huge engines; the fine proportions appeal pleasantly to the engineer. The essential proportions from which we find out the power of the engine are cylinders, 21 x 34 inches, driving wheels 55 inches diameter, and working boiler pressure 210 pounds per square inch by gage. Taking 90 per cent. of the boiler pressure as reaching the cylinders in starting or on a slow pull, the tractive force is 46,300 pounds. That means that the engine is capable of putting a pull of over 23 tons on the drawbar. It also means that the engine will pull over 7,700 tons on a level straight track,assuming the resistancetobe overcome as not more than 6 pounds per ton of load, included in engine and train.

Men not accustomed to the measuring of power can scarcely grasp the full significance of the figures quoted. It will be more of an object lesson to say that this engine is about as powerful as six of the 15 x 22-inch locomotives which were so popular only a few years ago.

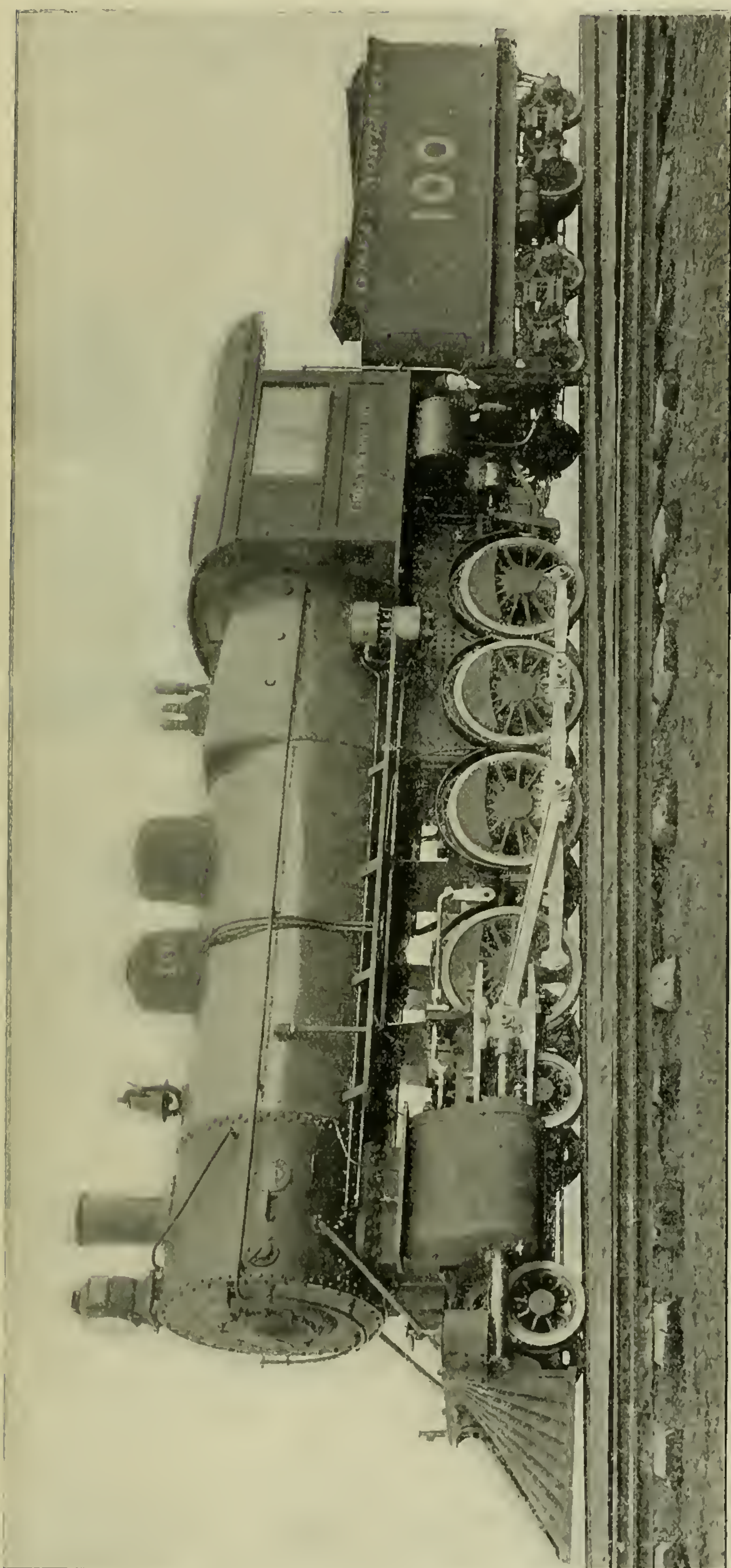
The boiler of the Player-Belpaire type is 87⅛ inches diameter at largest part, and 78 inches at smallest ring, being 6 inches more than any other locomotive boiler that we have record of. The fire-box is 124 inches long and 40½ inches wide, 86 inches deep in front and 79 inches at back end. The boiler has 376 tubes 2¼ inches diameter, 13 feet 10⅜ inches long, these with fire-box giving a total heating surface of 3,280 square feet.

The boiler, dome, steam chests, cylinders and cylinder saddles are lagged with Sal Mountain asbestos in order to reduce radiation and condensation to a minimum, as the engines are to be operated in the mountains of Montana, where the temperature frequently descends in inverse ratio of the altitude. The nozzles are set 30 inches in front of flue sheet and 36½ inches from the door. The improved Bell spark arrester is used.



Section taken on line A-B

CYLINDER AND STEAM CHEST OF LARGEST LOCOMOTIVE IN THE WORLD.



LARGEST LOCOMOTIVE IN THE WORLD.

The valves are of improved piston type and absolutely balanced. They are 16 inches diameter, as large as the pistons of many locomotives still in service. The piston rods are hollow, 4½ inches diameter, and are extended through the front head. The extension is 3½ inches diameter and is covered with extra heavy wrought iron tube.

The link radius is 40 inches, eliminating the bad work of a bent eccentric rod. The center of the valve rod is 3½ inches above upper rocker pin, for the purpose of giving lateral clearance between the rod and the front driving ti-e. The rod has a knuckle joint and is dropped again at its junction with the stem. The steam ports are 18 x 1¾ inches, and the exhaust port is 50 x 9 inches. The bridge is 6¾ inches wide. The valves have 1⅛ inches outside lap and ⅛ inch inside clearance, with 6½ inches maximum travel.

To control the tremendous force transmitted from the cylinders of these engines the main frame is forged solid 5 inches wide and 5 inches deep at the jaws and 4 inches deep at intermediate points of the top. The lower part is 3¼ inches thick at the jaws and 2½ inches thick between jaws. The journals of the driving axles are 9 x 11 inches, those of the engine truck 5½ x 12 inches. The main rod bearing is 6½ x 6½ inches; side rod bearings, 7⅜ x 5 inches; wheel fit, 7⅞ x 7 13-16 inches. The driving-wheel centers are of cast steel, made by Pratt & Letchworth, and Krupp tires are used for engine and tender.

The engine is equipped with Crosby safety valves, monitor injectors, Nathan lubricators, Jerome gland packing, Leach sanders, New York air brake, French springs and Curran chime whistle.

Every care has been taken to make the engine as light as possible consistent with the required strength. To this end wheel centers, engine truck wheel centers, driving boxes, driving box saddles, spring fulcrums, pistons, cylinder heads (front and back), crossheads and guide yoke ends are made of cast steel. Cylinder head casings, smoke box front and door, smoke-stack base, dome casing and sand-box casing are of pressed steel. Steam pipes of malleable iron, piston rods of O. H. steel, hollow and extended in front, crank pins of O. H. steel, crosshead pins of O. H. steel and hollow, rockers of hammered iron and hollow, rods of hammered iron, reverse lever, Player patent.

A customer, who had a few weeks before bought a tool from the Armstrong Bros. Tool Company, wrote: "It gives me more satisfaction to pay your bill than almost any other on my list. The boring tool sent to us by express paid for itself the first week. From this we figure that if we were equally busy the entire year, it would pay for itself some fifty-two times. It does double or more than double the work of our old tools."

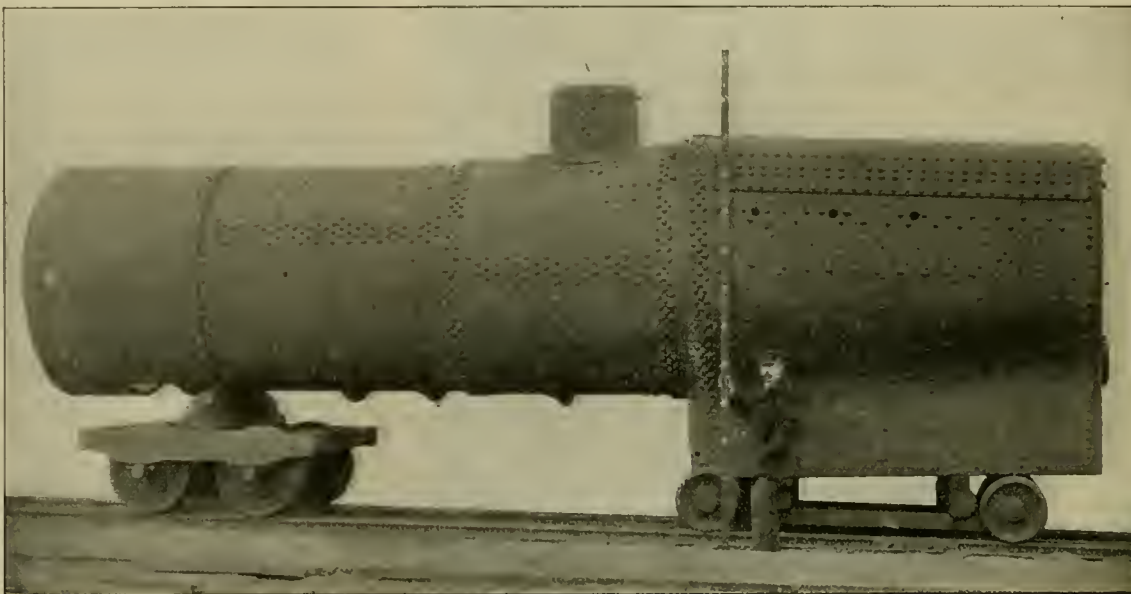
Interchange Disputes.

CINCINNATI, NEW ORLEANS & TEXAS PACIFIC RAILWAY COMPANY VS. CANDA CATTLE CAR COMPANY.

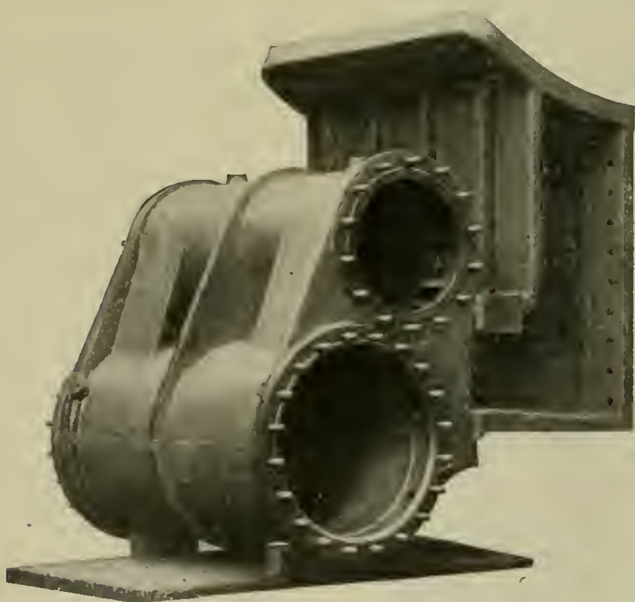
Air Hose Charged Repeatedly Against Same Car.—In March, 1897, the Cincinnati, New Orleans & Texas Pacific Railway Company rendered a bill against the Canda Cattle Car Company for repairs to cars during the months of February and March, 1897, including therein three charges for air hose applied to car 2094, each covered by a repair card stub, the first dated March 2d, the second March 17th and the third March 24th.

The Canda Cattle Car Company returned the bill, calling attention to the fact that these three repair card stubs each showed an air hose applied to car 2094 on account of hose being bursted, and to the fact that the first hose was applied on March 2d, the second March 17th, and the third March 24th, and it believes from these facts that the owner is not responsible for any of them, because, first, they did not fail under fair usage, and second, that the hose which the C., N. O. & T. P. Railway applied was either secondhand or worn out when applied, or the goods was of poor quality and unfit for service.

The C., N. O. & T. P. Railway Company replied that it finds from the movement of the car, that it was off its line between each of the applications of hose; it admits that three hose in one month appears to be a large number, but it does not see why, under the circumstances, it should not charge for them, as the replacing was made strictly in accordance with the rules, and the cause was in no instance due to unfair usage on its part.



BOILER OF LARGEST LOCOMOTIVE IN THE WORLD.



HALF SADDLE CYLINDER AND STEAM CHEST OF THE BIG DECAPOD.

The Canda Cattle Car Company returned the bill, stating that it could not entertain it in its present shape; that the rules require a repair card should be attached each time a hose is applied from any cause; that car 2094 bears no card of any other road than the C., N. O. & T. P. Railway Company for a hose, and it therefore believes that no hose failed except those applied when on the line of the C., N. O. & T. P. Railway, and that no hose was applied except such as was applied by that company; that it took the matter up with the road on which the car was between the dates of application of hose by the C., N. O. & T. P. Railway, and received reply that no hose was applied to the car while in such service.

Further correspondence failing to settle the matter, it is referred, by mutual consent, to the Arbitration Committee for decision.

Decision.—The failure of hose in service may or may not be due to fair usage, and therefore may or may not be chargeable to the car owner. It is not evident how three hose can be charged to one car within twenty-two days and come under the heading of fair usage. The only explanation offered is that the improper hose may have been applied while the car was on some other railroad company's lines. This argument cannot be accepted. It is evident some irregular work has been practiced in connection with the hose charge under consideration.

In the opinion of the committee, the charge for hose should be confined to one hose on either end of the car to which a hose was applied during this time.

CHICAGO GREAT WESTERN RAILWAY VS. KANSAS CITY, FORT SCOTT & MEMPHIS RAILROAD COMPANY.

Wrong Knuckle Used and Carded.—In February, 1897, the Kansas City, Fort Scott & Memphis Railroad Company rendered a bill against the Chicago Great Western Railway, including therein a charge of $2.50 for one Buckeye knuckle applied to M., K. & T. Railway box car 10060 upon a defect card of the C. G. W. Railway dated December 30th attached to this car, reading: "One Gould knuckle in place of Little Giant Buckeye."

The C. G. W. Railway returned the bill, objecting to the charge for Buckeye knuckle in place of Gould, for the reason that it considers the Gould knuckle which it applied to the car worth as much to the K. C., Ft. S. & M. Railroad people as it had charged when applying the same; that it considers that a labor charge for changing the knuckle only should be made.

The K. C., Ft. S. & M. Railroad Company replied that a Gould knuckle in a Buckeye coupler is inoperative, as the tongue of the Gould knuckle does not come in the right position to make the coupling safe, and that it made bill against the C. G. W. Railway because it found a defect card of that company on the car, which it understands is correct; that the M., K. & T. Railway runs into Kansas City over its lines from Paola, and that the C. G. W. Railway does the work of the M., K. & T. Railway at that point, and states that it is customary under the rules, when a foreign knuckle is found, to make a bill for the proper knuckle, giving credit for the one removed, as scrap, and that it could not use the second-hand Gould knuckle in repairing foreign cars; it calls attention to the fact that the new rules authorize no labor charge for replacing a knuckle.

The C. G. W. Railway replied that it had billed against the owner of the car for one Gould knuckle, $2.80, less one scrap Buckeye knuckle, or a net charge of $2.53, this bill having been made before a replacement price was listed for the Buckeye knuckle, and it does not understand why the scrap value only is allowed for a perfectly good knuckle, and refers to Arbitration Case 393.

Further correspondence failing to settle the matter, it is referred, by mutual consent, to the Arbitration Committee for decision.

Decision.—This is a case of wrong repairs. The Kansas City, Fort Scott & Memphis Railroad claims the Gould knuckle is worth only scrap to it. If the Chicago Great Western Railway Company chooses to make wrong repairs to a foreign car it is not in position to dictate how the wrong material shall be disposed of when removed for the purpose of making standard repairs.

The position of the Kansas City, Fort Scott & Memphis Railroad is sustained.

RUTLAND RAILROAD COMPANY VS. MICHIGAN CENTRAL RAILROAD COMPANY.

Drawbar Charged, Account Drawbar Strap and Bolts Broken.—In March, 1897, the Rutland Railroad Company rendered a bill against the Michigan Central Railroad Company for repairs to M. C. car 4126 on March 15th, as per repair card stub attached. The stub called for "One drawbar applied, two bolts 18 by ⅞ inches, one bolt 13 by ⅞ inches." The reason for the work being done was drawbar strap broken, bolts broken. The bill charged for:

3 hours' labor, 20 cents		$ .60
53 pounds wrought iron, 3 cents		1.59
180 pounds cast iron, 1½ cents		2.70
		$4.89
Credit—		
53 lbs. wrought iron, ¾ cent	$ .40	
180 lbs. cast iron, ½ cent	.90	1.30
		$3.59

The M. C. Railroad Company returned the bill, stating that if the drawbar strap was broken no charge should be made for the drawbar, and asks to have the bill corrected.

The Rutland Railroad Company replied that it considers it proper under the rules to charge for the drawbar when it is necessary to remove the same on account of defect to the drawbar strap; that the drawbar and strap are riveted together and form practically one article; that either cannot be removed without the other, and when removed they cannot be separated without considerable additional expense not contemplated by the rule allowing two hours for removing and replacing drawbar; it states that it does not think the exact location of the damage is material, providing it is such as to render the entire article unfit for use; it believes it has allowed full credit for all the material removed and can see no reason why the bill should not be accepted.

The M. C. R. R. Co. again returned the bill, stating that if the Rutland R. R. Co. found it more economical to remove both the drawbar and the drawbar strap when only the strap was broken, it would make no objection if the proper charges and credits are made; that the bill has charged 180 pounds cast iron at 1½ cents per pound, and allowed credit for 180 pounds cast iron in the good drawbar removed at ½ cent per pound, and yet admits that the drawbar was not broken; it does not object, however, to the charge as made for labor if the Rutland R. R. Co. will allow an additional credit of $1.80 on the bill on account of the good drawbar removed.

Further correspondence failing to settle the matter, it is referred, by mutual consent, to the Arbitration Committee for decision.

Decision.—A railroad company in repairing a foreign car is not justified in scrapping a good drawbar from a foreign car because it is more convenient or cheaper to it to do so, and the M. C. B. Rules of Interchange do not confer such a privilege.

The position of the Michigan Central Railroad is sustained.

The Siberian Railway of Russia and clear down to the Valadastock, Siberia, is being equipped with shops for repairing cars. The outfits of machinery for these shops were bought from the Egan Company, of Cincinnati, Ohio, U. S. A. The plants are not large, but there are many of them, and any one of them can, in a limited way, build cars complete as well as repair them. Prince Hillkoff, on his recent trip around the world, stopped off at Cincinnati, especially to visit the plants of the Egan Company, and he was much impressed with his inspection of this great woodworking industry, and found it more complete and better fitted up to turn out machinery than any he had found in America or elsewhere.

From the reports of the orders in hand during the thirty days just past, it is evident that our locomotive and car building plants are not languishing for want of business. These orders do not tax the capacity of the builders to any alarming extent, but they indicate unerringly the trend of business, since railroads as a rule do not consider it necessary to increase equipment without there is business in sight to employ it. Over 3,800 cars and 40 locomotives have been built or were nearing completion in the period named, embraced in orders strictly new. Of the cars 400 are steel throughout, a gratifying scrap of news to the advocates of the metal car.

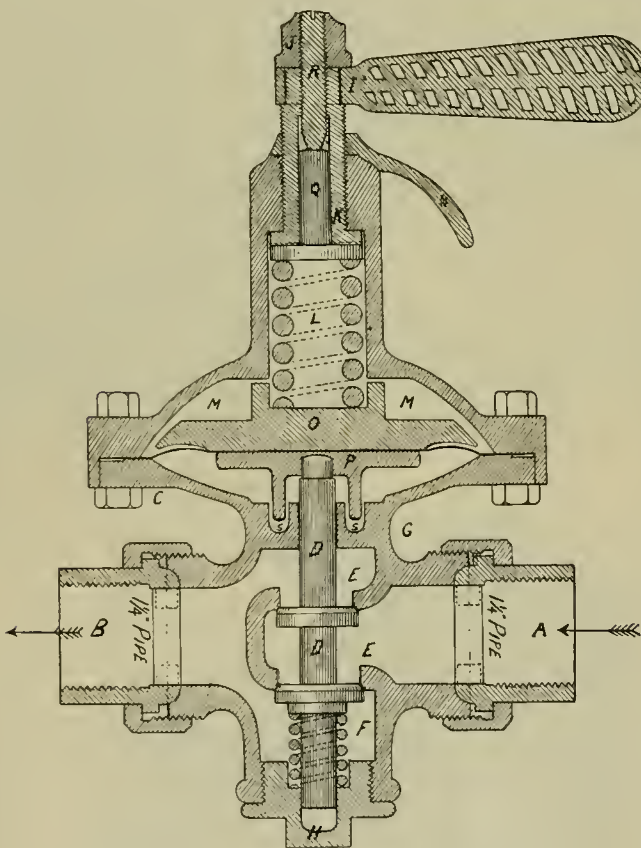
The big consolidation locomotives belonging to the Central Railroad of New Jersey have been pulling 130 coal cars from Phillipsburg to Jersey City. The officers of the road came to the conclusion the load mentioned was too light, and a trial was made with one of the engines hauling 150 cars. That long train was pulled without any difficulty, and now 150 cars is going to be the standard.

Gold's Improved Balance Valve Pressure Regulator.

Although the use of pressure regulators is becoming more and more extended every day, nowhere has the field of its desirability expanded so much as on the railroad. The heating of passenger trains by steam from the locomotive and the use of compressed air for shop purposes, have been very material factors in this result.

To reduce from a high initial pressure to a required minimum, and to always maintain the same result, regardless of the varying conditions on either side of the valve, has been quite a problem. Regulators of the old style, using pistons, have had their day; when first applied they gave some degree of satisfaction, but their liability to stick and clog up in a short time rendered them practically useless, and the locomotive engineers had no end of bother taking them apart, cleaning and re-setting them. Furthermore, the regulation from the old-style piston valve was never accurate, and the pressure which it delivered varied considerably as the supply and demand was increased or diminished. Mr. Edward E. Gold, who has invented and designed the new Gold balance valve pressure regulator, has had a great many years' experience with these particular devices, and in the valve which is herewith illustrated, he has embodied all of the improvements which his long experience has suggested.

For railroad-car heating, pressure regulators are of course a necessity, for, as a rule, but from 20 to 30 pounds of steam are required for the warming of an ordinary passenger train, and to maintain a desired uniformity of pressure, and consequent temperature, in the cars, a very sensitive regulator is required. To secure this result, a balance valve is quite necessary, and in extensive tests recently made with the one herewith shown, it was an easy matter to reduce from 160 pounds initial pressure to almost any fraction of a pound. Adding on cars or taking them off did not change the result in the slightest degree.



GOLD'S VALVE PRESSURE REGULATOR.

The regulator itself is made entirely of brass, the metal used being standard government composition. This is a decided improvement over regulators made of cast iron or partly cast iron and partly brass; for it is a known fact that when cast iron is used in the construction of these valves, the seats will rust and corrode, and as a consequence give more or less trouble. With the regulator made entirely of brass, all such difficulty is positively overcome. The fault which has heretofore been found with diaphragm valves has chiefly been that such diaphragms were not made in one solid piece, and that they were not sufficiently protected, so that when a break would occur (which was possible, owing to the inferior construction of such diaphragm), the scalding steam which would escape into the cab of the locomotive would cause considerable damage.

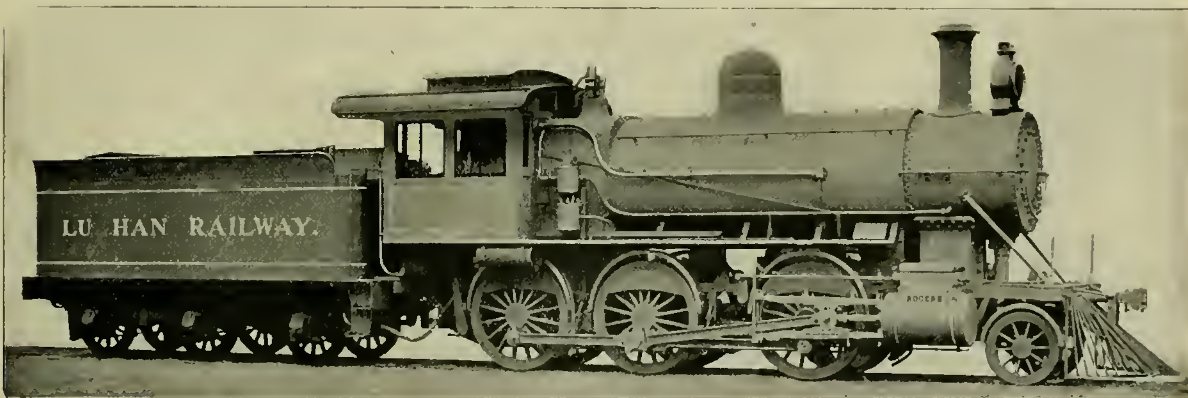
In the new Gold balance valve pressure regulator the diaphragm is one solid sheet of special composition, phosphor bronze, and, as may be seen, is slightly corrugated at the outer edge. To insure against undue straining of this diaphragm, the enlarged flange *O* has been provided, so that the diaphragm itself always maintains its original condition. The construction of this regulator, however, is such that, in the very improbable event of a diaphragm breaking, no serious damage would result, for the dome of the valve is solid composition, as shown, and would be a positive preventive against any such trouble. The standard size of this balance valve, as manufactured by the Gold Car Heating Company, is inch and a quarter, and is fitted with heavy brass unions *A* and *B*. The recess shown at the point *S* provides a water seal, and this prevents any chattering whatever; the regulator being absolutely noiseless in operation. It is set by the handle *I*, which is made of composition and perforated similar to the old-fashioned stove lifter. This handle combines strength and durability, and is perfectly cool at all times. When once set for the proper supply, the handle is secured by the lock *N*. The set screw *R* is provided as a check on either the maximum or minimum amount of pressure required; for it can be seen, on referring to the illustration, that the play of the spring *L* is controlled by this set screw *R*. The spring *L* provides an even bearing at all times, as it has flattened ends and is allowed no lateral motion. This spring being above the diaphragm and encased by the dome of the regulator, is always as positive as when originally applied. The lower spring *F*, which helps to guide the spindle *D D*, is made of special composition, and is not affected by steam or any of the liquids for which pressure regulators are used.

The Gold balance valve pressure regulator is absolutely accurate in operation when used with either steam, air, gas, water, or any other liquids ordinarily controlled by this character of device. It is thoroughly mechanical in all its details, and the fact that it is being put on the market by the Gold Car Heating Company, of New York and Chicago, is sufficient guarantee that its construction and the workmanship put into it are all that could be desired.

The Delaware & Hudson people are building a locomotive in their shops at Green Island.

Rogers Mogul for China.

The very handsome mogul engine hereby shown was built by the Rogers Locomotive Company for the Lu Han Railway, of China. This engine has the standard gage, and has a total weight of 125,500 pounds. The weight on the drivers is 105,000 pounds. The wheel base is 22 feet 9 inches, and the driving-wheel base 13 feet 9 inches. The engine has cylinders 19 x 24 inches, and the drivers 60 inches diameter, which give a mean piston pressure of 144.4 per pound of cylinder pressure. The engine throughout shows indications of very careful design, no expense being evidently spared to make it first class in every part. The driving-wheel centers are steel, and the driving-wheel journals are 8 x 10 inches, and the truck journals 5½ x 12 inches. The axles are of steel.



ROGERS MOGUL FOR CHINA.

The steam ports are 17 x 1⅜ inches, and the inside port 2¾ inches wide. Richardson balance valves are used, the greatest travel being 5½ inches. The outside lap is 13-16 inch, and the lead in full gear is 1-16 inch. The boiler, as will be seen by the engraving, is of the Belpaire type, with a working pressure of 180 pounds to the square inch. Boiler and firebox are of steel.

The heating surface of the firebox is 126.45 square feet, the heating surface of tubes 1,503.35 square feet, making a total of 1,629.08 square feet. The grate area is 24.2 square feet. The thickness of the barrel is 9-16 inch, and the diameter at first course is 60 inches. The horizontal seams are sextuple riveted, and the circumferential seams double riveted. The crown sheet is held up by radial stays.

There are 214 tubes 2 inches outside diameter, the length over sheets being 13 feet 5 inches. The length of the firebox is 7 feet, and its width 3 feet 5½ inches. Its depth at front is 69½ inches, and at back 61½ inches. The side, back and front sheets are of copper, and the tube plates of steel. The thickness of the sheets is ½ inch. A brick arch is employed, supported by studs. United States metallic packing is used for the piston rods and valve stems.

There is nothing specially novel about the engine, but it is a sensible sort of machine, that is certain to give high satisfaction in a country where the laboring facilities are not of the best.

Some time ago the Pennsylvania Railroad Company built five locomotives of the consolidated type. So satisfactory has been the hauling power of these locomotives that the company is now building five more of the same type. The company has now over 90,000 freight cars equipped with the automatic coupler, and 60,000 with air brakes and automatic couplers. All the locomotives of the company, which number about 3,700, are equipped with the automatic air brake, and all the passenger cars, numbering about 4,000, have both the automatic coupler and air brake.

A Queer Locomotive.

The Minister of Railways and Canals of Canada has been given authority to put the government railways of that colony on a modern footing. In connection with this decision, he has begun to put the Intercolonial on a footing with the best roads on the continent of America, as he expressed it. In the adoption of this policy he purchased a Vauclain locomotive from the Baldwin Locomotive Works.

In describing this machine, a Montreal paper says: "The locomotive is a double compound of the newest Vauclain patent, mounted with a boiler 60 inches in diameter, 27 feet long, with a grate surface of 26 feet. She is what we call a ten-wheeler, having a truck of five wheels and six flywheels, six feet across."

This powerful new locomotive, which will be known as No. 168, will serve as a model for many others of the same kind, which the government intend having made in this country. Mr. Vauclain, the patentee, who is a leading authority on locomotives, is a partner in the Baldwin firm, and it will be a surprise to many to learn that he is a French-Canadian, having been born a few miles from St. Hyacinthe."

A report is current that a Kansas legislator is going to introduce an act into the legislature prohibiting snoring in sleeping cars. He proposes making sleeping car companies keep a sufficient force of porters in the sleeping cars to arouse every person who begins to snore. We are inclined to think that it would take a pretty good force of porters to stand the lickings they would get for awakening a sleeper and accusing him of snoring—an accusation that is always received as adding insult to injury.

The Schenectady Locomotive Works are putting up a large new shop, to be used for the construction of locomotive tenders. These works are very busy at present, and it is stated that more men are employed than have been in the shops for four and a half years. Several of the departments are running with double force night and day.

Mr. Henry H. Sessions, formerly manager of the Pullman Company's Works, at Pullman, and for many years connected with prominent railroads as master car builder, has been elected vice-president and a director of the Standard Coupler Company. Mr. Sessions will have an office at 522 Monadnock Building, Chicago, and will give special attention to the Standard steel platform, which was designed by him, and which is owned by the Standard Coupler Company.

The Missouri Car & Foundry Co., of St. Louis, have obtained control of the Madison Car Works, located at Madison, Ill. These works have been closed for upwards of a year. The intention of the parties controlling the property is to start the shops immediately.

WHAT YOU WANT TO KNOW.

Questions and Answers.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

Our correspondents to this department do not seem to understand that all anonymous communications go to the waste basket. Questions must be accompanied by full name and address, not for publication, but to establish the identity of the writer.

(1) G. O. E., Cincinnati, O., asks:

Will you please say how long the sand blast has been used in ornamental work on glass and metallic surfaces? A.—The process was brought out in 1871. See Appleton's "Cyclopedia of Mechanics."

(2) E. L. G., St. Paul, Minn., asks:

Do the driving wheels on either side of a locomotive, slide on the rail when rounding a curve? A.—See question No. 87, in our December issue, where a similar query, about car wheels on curves, is discussed; the answer is true for your case.

(3) G. D. O., Cleveland, O., writes:

In case a Richardson balanced valve has a broken spring, how can the defective side be located? A.—You are referred to our July and August (1896) issues, where the subject of blowing balanced strips is treated at some length, too long to repeat in this column.

(4) S. A. D., Holyoke, Mass., asks:

In designing a link motion for a locomotive, how is the throw of eccentric determined? A.—Such a throw is given to the eccentric as will cause the valve to travel an amount not less than twice the lap plus twice the steam port. Thus, if lap equals ⅞ inch and steam port equals 1¼ inches, the travel must equal $(0.875 + 1.25) \times 2 = 4.25$ inches.

(5) H. G. L., Bridgeport, Conn., asks:

1. Are there any stated number of washout plugs used in locomotive boilers? A.—No. 2. What are the proper places to locate such plugs? A.—At the corners in the leg of firebox, and front and back, and also at sides of same, just above mud ring; above crown sheet at sides of firebox, and in front flue sheet. 3. Are brass plugs preferable to iron? A.—Yes.

(6) A. L. D., Camden, N. J., asks:

1. Can you say about what is the sustaining power of a boiler flue in a flue sheet to prevent bulging, when the flue is expanded and beaded? A.—Experiment has shown that it requires a force of about 25,000 pounds to start a flue under those conditions. 2. What resistance is there in a tube when only expanded in the sheet? A.—From 12,000 to 14,000 pounds.

(7) O. B. C., Chattanooga, Tenn., writes:

1. I have trouble with loose babbitt after pouring in boxes; can you suggest a remedy for it? A.—Warming the boxes before pouring should stop the trouble. 2. How can I overhaul a steam gage and make it register correctly. A.—We cannot say at this distance. If we knew the make of gage, it might be possible to answer the question; if the gage is chronically off, the best way to overhaul it is to scrap it and buy a new one.

(8) H. A. L., Augusta. Ga., writes:

The engineer I fire for contends that driving-box wedges should be not less than .01 of an inch wider apart than the distance over their bearing faces on the box, in order to give proper freedom to the movement of the box in the jaws. This amount seems to me to be too great. Will you please say who is right? A.—Best shop practice makes an adjustment of the wedges, such that the driving box will fall in the jaw by its own weight. The wearing faces are therefore nearer together than the distance stated, and you are right.

(9) G. H. F., Montreal, P. Q., asks whether the outside or inside of a flue is taken as heating surface, and how the latter is calculated. A.—The outside surface of the flue is used in computing heating surface. To find the area of the surface of the flue in square feet, multiply its circumference in inches by its length in inches, and divide by 144. For a 2-inch flue, 10 feet long, the area in square feet would be:

$$\frac{3.1416 \times 2 \times 120}{144} = 5.23.$$

The operation is correct for any other size of flue by substituting the correct diameter and length for the figures shown.

(10) E. F. O., Harrisburg, Pa., asks:

1. Please explain the meaning of the word "viscosity," as used in connection with lubricating oils. A.—Viscosity is that property of the oil that keeps the wearing surfaces apart, as in a journal and its bearing. 2. What is meant by the flashing test of oils, and how is it made? A.—The flashing test is made to determine at what temperature the oil will ignite, and is made, according to the Pennsylvania Railroad specifications, by heating the oil in an open vessel, and increasing the temperature not less than 12 degrees a minute, and applying the test flame every 7 degrees, beginning at 123 degrees Fahr.

(11) J. A. C., Chicago, Ill., asks:

Will giving an engine lead make her smarter in starting a train; if so, why? I know a majority of old runners claim it makes an engine start quicker to give her lead; but I think it is just the reverse. A.—The consensus of opinion among the best valve experts answers your question in the negative, and the reasons on which their position is based are due to experiment, and not conjecture. Lead in full gear at starting must have an effect that will make an engine anything but smart, since steam is admitted to the cylinder when the crank angle is too small to exert any turning effort; the incoming steam is therefore powerless to move the piston, and its pressure is expended in causing friction that must be overcome before the engine can move. Another evil following lead in full gear is, that the lead at short cut-offs is magnified with short or ordinary lengths of eccentric rods, the lead increasing so rapidly as to be a serious hindrance to high speeds, owing to the resulting compression. A lead—whether positive or negative—that will develop the greatest power in a cylinder, will be the proper lead to make an engine smart, and that lead is best found by the use of the indicator.

(12) H. E. M., Monson, Me., writes:

I have made a hot-water heater to heat my engine house, by putting a coil of ¾-inch pipe in each side of a wood stove which is located in the middle of the house, and connecting the coils at top and bottom by means of tees, run the pipes out through the stove. The bottom pipe runs from the stove to the back end of the house to a tee, and then runs to each side of the house and connects with a radiator made of 1-inch pipe. The steam pipe from the stove runs up about 7 feet from the floor, and then runs to back end of building to a tee, and from the tee to the radiator on each side by a ½-inch pipe. The trouble is, the water does not circulate, and I would esteem it a great favor if you would solve the problem for me. A.—The lack of circulation is due to the small piping, especially that part reduced to ½ inch, and the arrangement. The piping should be not less than 1¼ inch throughout the system, and a hot-water reservoir should be placed above the stove at about the present hight of steam pipe, to receive the pipes from the top of coils, of which there should be two, one for each coil. Two circulating pipes should drop from the reservoir, and run to the heaters, one for each. The returns should leave the opposite end of radiators and connect with bottom of coils. All bends should be as long as possible, avoiding elbows, to encourage a free circulation. On account of the location of radiators, as proposed, this separate two-pipe system is believed to be the best for that case. A safety valve is necessary with this system; explosion is likely to occur without it.

We are informed by the Detroit Lubricator Co. that the Trippett attachment to their lubricator offers a means by which the back pressure in oil pipes can be positively and automatically overcome. Where their device is in use there is no difficulty in having the oil flow steadily from the lubricator to the steam chests.

Car Lighting.

When railway cars were first introduced, the proprietors did not think that lighting the cars at night was any more a necessity than it was to light stage coaches. Railroads had been carrying passengers in this country several years, when an advertisement was put into a Baltimore paper intimating that a certain railroad was so solicitous for the comfort of its patrons, that two candles had been put in each car of the night train. That was sufficient to make the darkness visible, and it was the kind of light luxury provided for many years. In 1883 the writer examined one of the pioneer passenger cars, and it showed traces of all the kinds of lighting devices that had been tried for forty years, and the users had returned to candles.

A great variety of oil lamps was tried, and some of them threw a very good light upon the roof, but they were a delusion to the person who tried to read by them. The line of progress was towards gas, and a great many systems of gas lighting were tried. None was satisfactory, until the Pintsch gas was introduced. That system is now general in the United States, and is entirely satisfactory. The cars are very well lighted, and the jets of gas run from 200 to 300 candle-power for each car.

Electric lighting has been introduced on some railroads, but it does not increase in popularity.

The Big Four has given notice that the passenger equipment in use on the system being provided with vertical plane coupler, Gold steam heat coupler, Westinghouse air whistle signal and quick-acting air brake, the transportation department requires that cars for movement in passenger trains be similarly equipped. While it is desirable that cars be equipped with steel-tired wheels, it is not an absolute necessity. The Gold and Sewall steam heat couplers being interchangeable, cars equipped with either of these couplers will be accepted. No arrangement can be made for movement on passenger trains of cars of any description not provided with these appliances.

The Sargent Company, of Chicago, have sent out a very attractive illustrated calendar, showing the nature and scope of the business the company is doing. One-half of the dozen pictures making up the design are given to the railroad department. They show three types of brake shoes; also a fancy sketch in the shape of a star, devoted to the latest improvement in this line—the Diamond "S" brake shoe. Anyone wishing to have a very artistic calendar which embraces utility with beauty, should send for it. The address is Old Colony Building, Chicago, Ill.

The Schenectady Locomotive Works—Intercepting and Separate Exhaust Valves for Compound Locomotives.

The intercepting valve shown in the accompanying engravings was designed by Mr. A. J. Pitkin, vice-president and general manager, and Mr. J. E. Sague, mechanical engineer of the Schenectady Locomotive Works, and is their standard construction for compound locomotives. The details and working of intercepting valves are, as a rule, regarded as very complex, by the average engineman, but we believe no difficulty will be had in comprehending the sectional views from the following description:

Fig. 1 gives sections through the smoke arch and cylinder saddles, and shows the

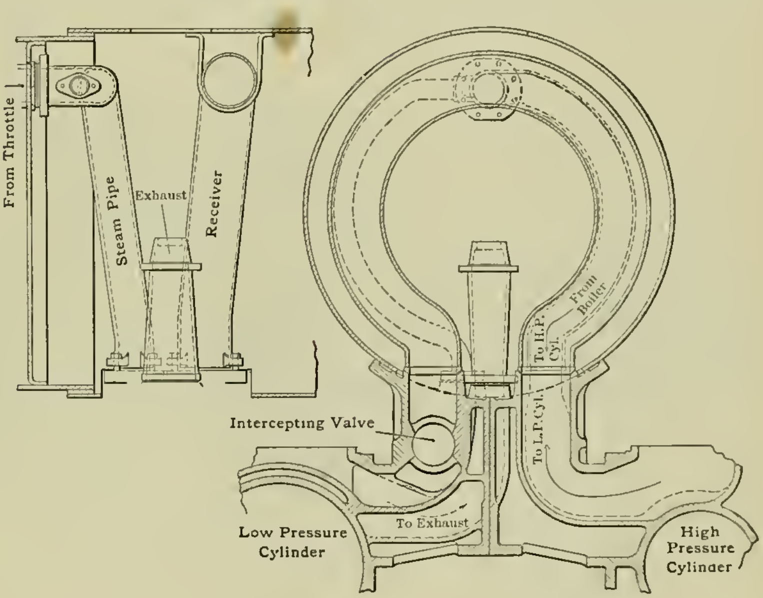


Fig. 1. INTERCEPTING VALVE—PIPES.

steam passages, the receiver, and the location of the intercepting valve in the low pressure cylinder saddle. Fig. 2 is a vertical section through the low pressure cylinder saddle and intercepting valve, and shows the intercepting and separate exhaust valves in the position taken when engine is working simple. Fig. 3 shows the same section through the low pressure cylinder as in Fig. 2, and shows the intercepting and separate exhaust valves in the position assumed when engine is working compound. Fig. 4 shows two transverse sections through the low pressure cylinder saddle *A B* and *C D*, for location of which see Fig. 3. Section *A B* shows the passages for admitting live steam into the low pressure cylinder, and section *C D* shows the outlet passage from the separate exhaust valve to the main exhaust pipe.

With the arrangement of valves shown in these figures, the engine can be started and run either compound or simple and can be changed from compound to simple or from simple to compound at the will of the engineer, with any position of throttle, and at any point of cut-off. The part which each valve does in accomplishing this is as follows: The separate exhaust valve when open allows the steam to exhaust direct from the high pressure cylinder to the atmosphere without going through the low pressure cylinder, thus working the engine simple, and when closed causes the steam from the high pressure cylinder to go through the low pressure cylinder, thus working the engine compound. The intercepting valve closes the passage between the cylinders when the separate exhaust valve is open, so that steam cannot go from the high pressure cylinder to the low pressure cylinder, and it admits steam to the low pressure cylinder direct from the dry pipe through the reducing valve. When the separate exhaust valve closes, the intercepting valve opens the passage between the cylinders and cuts off the supply of steam from the dry pipe to the low pressure cylinder.

The reducing valve works only when the engine is running simple, and throttles the steam passing through it, so that the pressure of steam going to the low pressure cylinder is about one-half the steam pressure in the dry pipe. The intercepting and reducing valves are worked automatically by the steam pressures acting on the difference of areas of the ends of the valves, and their movement is cushioned by dash pots. The separate exhaust valve is operated by the engineer, by means of a three-way cock in the cab. To open the separate exhaust valve the handle of the three-way cock is thrown so as to admit air or steam pressure against the piston *J*. Pulling the handle back relieves the pressure against *J* and the spring, which is shown in the figures, shuts the valve. All the engineer ever has to do in connection with the operation of the valves is to pull the handle of a three-way cock in the cab, one way or the other, according as he wishes the engine to run, simple or compound. The engineer uses this handle under the following conditions:

First, to start simple. Under ordinary conditions this is not necessary; but if the maximum tractive power of the engine is needed to start a heavy train, the engineer pulls the handle of the three-way cock, so as to admit pressure on the piston *J*, Fig. 3. This will force the piston *J* into the position shown in Fig. 2, which opens the separate exhaust valve and holds it open. As soon as the throttle is opened, steam at boiler pressure enters the chamber *E*, and forces the intercepting valve against the seat *F*, as shown in Fig. 2. Steam enters the high-pressure cylinder, and is exhausted through the receiver pipe and separate exhaust valve to the atmosphere, as shown in Figs. 1 and 2. Steam also enters the low-pressure cylinder from chamber *E* through the reducing valve and ports *G*, shown in Figs. 2 and 4, and is exhausted in the usual way. The steam is prevented from reaching the low-pressure cylinder at boiler pressure by going through the reducing valve. As will be seen from Fig. 2, the valve is partly balanced by the cylinder open to the atmosphere, and the boiler pressure acting on the unbalanced area throws the valve to the right. When the pressure on the right of the valve becomes high enough, it will throw the valve to the left, because it acts on the whole area of the valve, and in so doing throttles the steam to the proper pressure for the low-pressure cylinder.

Having started the train in this way, when the engineer wishes to change the engine from running simple to running compound, he pushes the handle of the three-way cock to its first position, which relieves the pressure on the right of the piston *J*, and the spring throws that piston to the right, into the position shown in Fig. 3, closing the separate exhaust valve. As soon as this valve is closed, the pressure in the receiver rises and presses the intercepting valve to the left against the pressure in chamber *E*, which only acts on an unbalanced area of the valve. The receiver pressure holds the intercepting valve to the left, as shown in Fig. 3, closing the ports *G* and opening a free passage from the high-pressure cylinder to the low-pressure cylinder, and the engine works compound.

It will be noticed that while working compound, which is the usual way of working the engine, the intercepting and reducing valves are both held against ground joint seats, which prevent the leakage of steam that may have leaked past the packing rings. Now, with the engine running compound, if the engineer wishes to run the engine simple, because of a heavy grade, he pulls the handle of the three-way cock the same as for starting simple. This will open first the by-pass valve *K*, and then the separate exhaust valve; the by-pass valve relieving the pressure more gradually than if the large valve was opened at once. As soon as the separate exhaust valve is open, the pressure in the receiver drops and the intercepting valve is forced against the seat *F* by the pressure in chamber *E*, and the engine runs simple as before. When the grade is passed, the engineer pushes the handle of the three-way cock over, and the engine begins to work compound. To start the engine compound, the separate exhaust valve is left closed, as in Fig. 3, and when the throttle is opened, the intercepting valve will be forced against the seat *F* by the pressure in chamber *E*, as shown in Fig. 2. The low-pressure cylinder will then take steam through the ports *G*, and the high-pressure cylinder will exhaust into the receiver for a few strokes of the engine. This will raise the pressure in the receiver and force the intercepting valve into the position shown in Fig. 3, closing the ports *G*, and the engine will run compound.

The combination of the automatic intercepting valve with the separate exhaust valve permits the engine to be changed from simple to compound, and the reverse, very smoothly and without danger of jerking the train, and in recent tests the engine was changed from compound to simple and the reverse repeatedly, when operating at a maximum power, with the throttle remaining wide open.

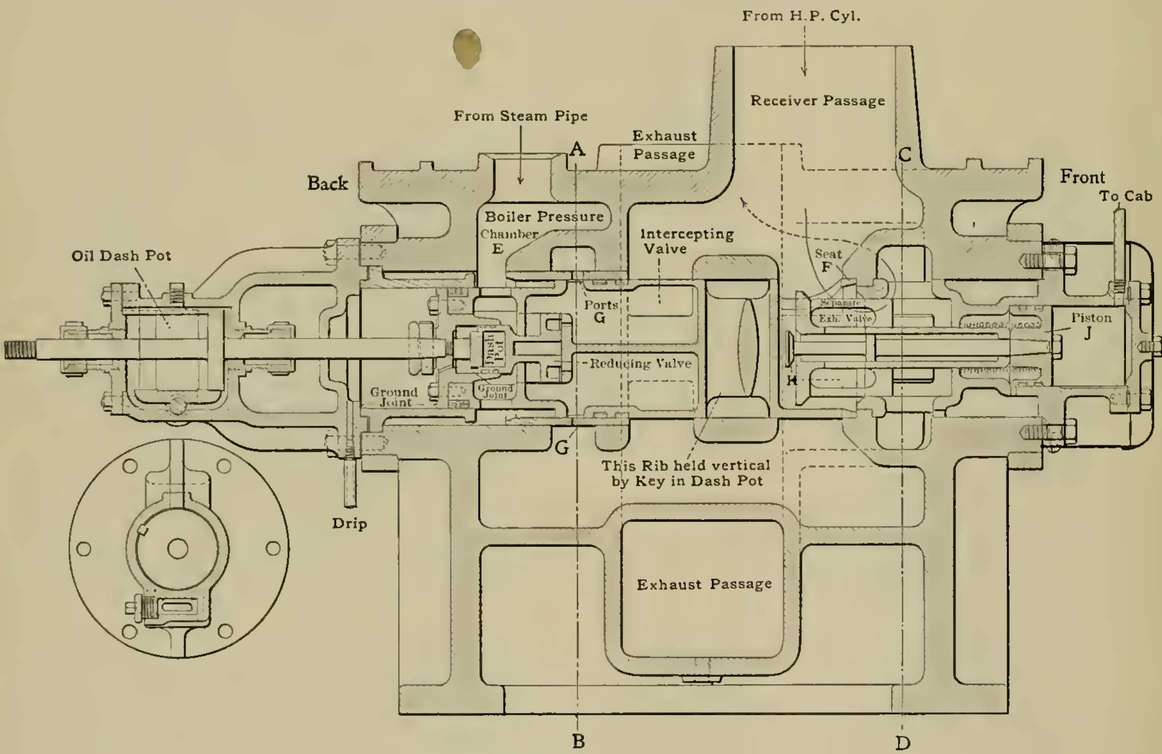


Fig. 2. INTERCEPTING VALVE—SIMPLE POSITION.

The Effect of Brake Beam Hanging Upon Brake Efficiency.

Under the above title, one of the most interesting and instructive papers ever presented to the New York Railroad Club was up for discussion at the November meeting. In his introductory remarks, the author, Mr. R. A. Parke, of the Westinghouse Air Brake Company, said:

"Mr. Chairman: The object in presenting the matter in the paper which has been prepared for this evening has been two-fold. One of the two actuating motives was a desire to clear up in the minds of some the question as to the propriety of applying only a 70 per cent. braking power upon air-braked freight-cars, while it is customary to apply a 90 per cent. braking power on passenger equipment The advisability of increasing the brake-shoe pressure upon freight-cars, so as to make it more nearly conform to the braking power on passenger equipment cars, has been frequently discussed. There did not appear to be any good reason in the minds of many why the braking power on freight cars should be so limited, especially in view of the fact that freight-cars are generally laden with more or less burden in addition to their empty weight, and, of course, under such conditions, the braking power becomes a still smaller percentage of the loaded weight of the car. I believe that in some instances it has even been undertaken to increase the braking power upon freight-cars. As before stated, one of the principal purposes of this paper is to show that the braking power now normally carried by the rear pair of wheels of each truck is transferred to the forward pair of wheels during a brake application. In the paper which has been prepared for to-night, various illustrations are offered to make this fact more easily apparent. It is not quite clear, without a careful investigation of the conditions, just how much of a transfer of weight occurs, but I think it will be quite easily understood that some transfer of weight always takes place. It is pointed out in the paper that the force that stops the moving vehicle is almost entirely that which is what we call adhesion or rail friction, and which is applied to the lowest points of the moving car. The application of retarding force at the rails resists the motion of the car, and, because of the influence of in-

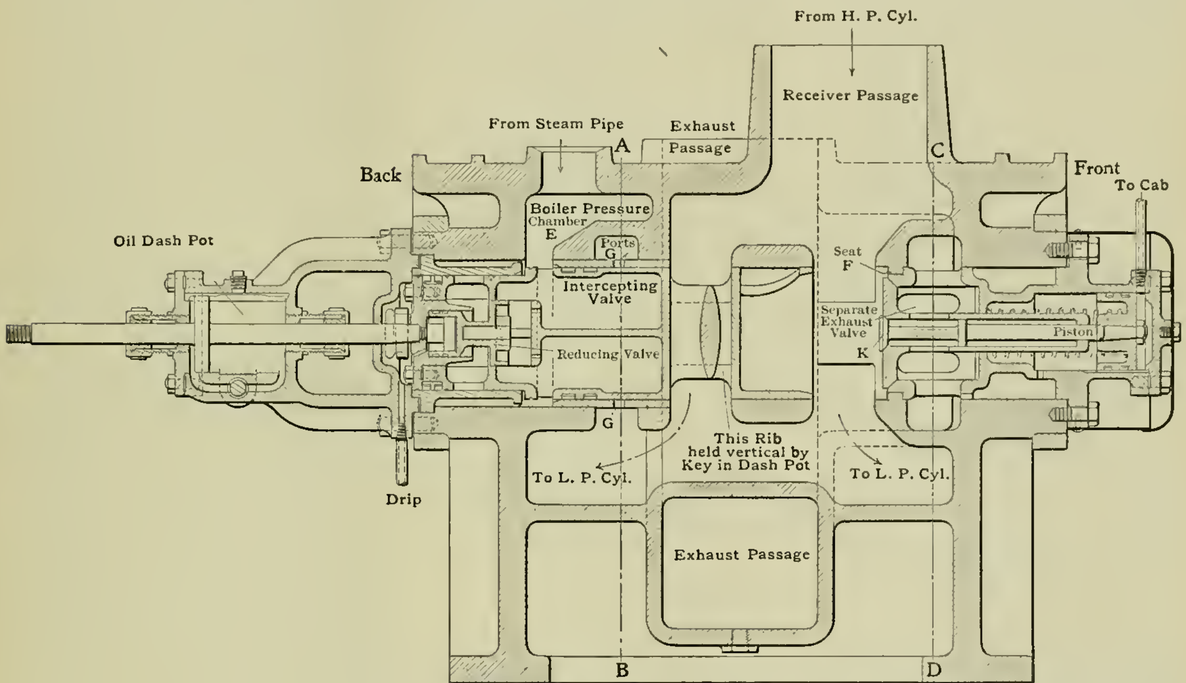


Fig. 3. INTERCEPTING VALVE—COMPOUND POSITION.

cars. What is customarily known as the braking power is that proportion of the entire weight of the empty vehicle which is distributed over the various wheels in the shape of brake-shoe pressure; that is, the aggregate pressure of all the brake-shoes upon all the wheels, as calculated from the brake cylinder pressure, is denominated the braking power, and is expressed as a percentage of the weight of the empty vehicle. It has been customary, ever since air brakes began to be applied to freight-cars—or for a long time, at any rate—to use a calculated brake-shoe pressure upon the wheels which aggregated only 70 per cent. of the weight of the car, while in passenger service it has always been customary to use a braking power—that is, an aggregate pressure of all the brake-shoes upon the wheels—amounting to 90 per cent. of the weight of the car. employed upon freight-cars is just as liable to slide the freight-car wheels, when the cars are empty, as the greater braking power upon passenger cars is to slide the wheels of passenger cars. It is unquestionably the fact that the maximum braking power which can be applied to vehicles is that which can be used without injurious sliding of the wheels.

"The principal reasons why no greater braking power can be used upon freight-cars without a greater tendency to slide the wheels than that in passenger service with a 90 per cent. braking power is that, the cars being shorter and the wheel-base of the trucks also being shorter than is the case with passenger equipment cars, a greater proportion of the load normally carried by the rear truck is transferred to the forward truck in a brake application, and a greater proportion of the weight ertia, acting at the center of gravity of the car body, it tends to cause a rotative action of the car body, thereby removing a portion of the weight from the rear truck and transferring it to the forward truck, and a rotative action of the truck which transfers weight from the rear to the forward pair of wheels of each truck. Those who in the past have had experience with riding a high wheel will realize something of this rotative tendency; indeed, those who ride the ordinary "safety" —and I suppose that includes everybody here—may also have had some experience of this transfer of weight. With a high wheel, the forcible application of the brake, whereby a resistance to the rotation of the wheels is productive of a frictional resistance between the earth and the point of contact between the earth and the wheel, will be very sure to cause a rotative movement that overturns the whole machine and lands the rider up standing. It will equally well be recognized that, in going down even a moderate incline at a rapid rate, the forcible application of the brake may cause the rider to go over the handle-bars of the safety wheel. This transfer of weight is always present when a retarding resistance is introduced at the lowest point of the vehicle. It is, as I hope, demonstrated in this paper that a remarkably good selection of braking powers for freight and passenger equipment has been used all these years. It is true almost beyond dispute that a 70 per cent. braking power upon freight-cars will cause just as strong a tendency of the rear pair of wheels of the rear truck to slide upon the rails as will a 90 per cent. braking power on passenger cars. The rear pair of wheels in each case is the pair most likely to slide, and therefore the braking power upon the car must be so restricted upon all the wheels, in the ordinary custom of applying brakes, that it shall not slide the rear pair of wheels. The result is that the 70 per cent. braking power is unquestionably just as liable to slide wheels as is the 90 per cent. braking power upon passenger equipment; but it is also as effective in stopping the car as is the greater braking power upon passenger cars—not quite as effective, to speak exactly, but it is very nearly so. This is another feature of the case which is brought out, to a partial extent at any rate, in the paper.

"For a long time it has been customary to suppose that the old law of Morin is applicable to the friction of brake-shoes upon car wheels. That law implies that the friction developed between two surfaces is proportional to the pressure between those surfaces. This we know to be entirely untrue. The friction developed between a brake-shoe and a wheel, with a pressure of 1,000 pounds upon the brake-shoe, is considerably more than one-half of the friction developed by the same brake-shoe upon the same wheel with 2,000 pounds pressure. In other words, the coefficient of friction is itself a function of the pressure per square inch between the two surfaces. It thus occurs that with the very much reduced pressure of freight brake-shoes upon their wheels—ordinarily in the neighborhood of 2,500 to 3,000 pounds—the friction developed is a considerably greater proportion of that pressure than is the case where the brake-shoes are applied to passenger-car wheels with a pressure of 7,000 or 8,000 pounds. In that way the actual retarding force upon the freight car, due to a 70 per cent. braking power, is very nearly as great a proportion of the weight of the car as is the retarding force developed with a 90 per cent. braking power on passenger cars.

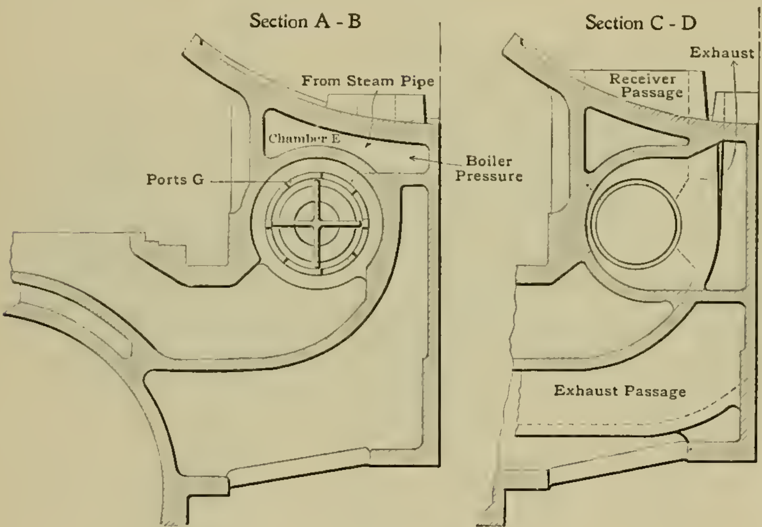


Fig. 4. INTERCEPTING VALVE—PASSAGES.

"There are one or two errors of statement in the paper in regard to this question of friction. The main portion of the work of preparing this paper was completed about eighteen months ago, before the second report of the Master Car-Builders' Committee upon laboratory tests of brake-shoes had been published, and before I was acquainted with the results of their later investigations. I have been so pressed recently for time that I have found it very difficult to get the material of the paper together at all, and have not been able to fully analyze the 1896 report of the committee, or to recalculate the braking power of passenger cars with chilled cast-iron wheels, in accordance with the most recent information.

"The other feature of the paper which it has been attempted to bring out, grows out of the very fact that, during an application of thé brakes, less pressure is carried to the rails by the rear pair of wheels than is carried to the rails by the forward pair of wheels of each truck. To prevent wheel sliding, it has been necessary, in applying the same brake-shoe pressure to each pair of wheels, to so restrict that brake-shoe pressure that it shall not slide the pair of wheels which rests more lightly upon the rails, and which is therefore more likely to slide. It will thus be easily understood that a considerable retarding friction is sacrificed at the forward pair of wheels where the pressure of the brake-shoes is much less than could be utilized without liability of sliding that pair of wheels. The purpose of the investigation which has been presented in this paper has been to devise a method by which the pressure of the brake-shoes upon each pair of wheels may be proportioned to the weight which that pair of wheels carries to the rails during the maximum application of the brakes—that is, the emergency application. A solution of this problem has been discovered in hanging the brakes between the wheels, instead of outside of the wheels, as has been the custom in passenger service, and in inclining the brake hangers outwardly, or away from the wheels, thereby reducing the friction of the brake-shoes upon the rear pair of wheels and increasing it upon the forward pair of wheels of each truck. When the car runs in one direction this simple expedient operates in precisely the same way that it does when the car is going in the other direction, from the simple fact that the conditions are reversed, and what was the forward pair in the one case becomes the rear pair in the other case, when the direction of motion of wheels is reversed. It introduces no additional mechanism upon the car, but simplifies that already in use. It has the advantage of doing away with brake-beam release springs, which are a very serious obstacle to good operation of the brakes. The brakes fall away by gravity on account of the inclination of the hangers and there is no necessity, therefore, of using release-springs. The expense of applying them is saved, and the great uncertainty as to the extent to which they interfere with the proper application of the brakes is removed. It has been frequently observed, doubtless, by all of you, that, as a passenger train draws into a station with the brakes applied, the trucks tilt forward. The forward end of the truck is depressed and the rear end is elevated. This is partially due to the fact that the car body is dragging the trucks forward against the resistance of the rail friction which is applied to the lowermost points of the wheels. That in itself tends to tilt the trucks forward. But, in addition to that, the rear brake-beam, being hung outside of the wheels, is pushing upwardly upon the truck frame while the forward beam is dragging downwardly, through the friction of the brake-shoes. So these two things both tend to tilt the truck, and when the car is just about coming to a stop, the release of the brakes rights the truck up suddenly, and not infrequently throws passengers down who are standing in the aisles. By hanging the brakes between the wheels in the manner indicated in the paper, the friction at the rear brake-beam pulls down upon the rear portion of the truck frame, although from a point much nearer the center, while the forward brake-beam pushes up, thus tending to neutralize, instead of aggravating, the tilting of the truck. Some experiments have been made with the brakes hung inside upon passenger trucks of Canadian Pacific cars so equipped, and it was very noticeable that, as the train came into the station and drew up to the platform, the truck-frames were almost unmoved during the stop and after the stop had occurred. That jolting motion was very greatly reduced.

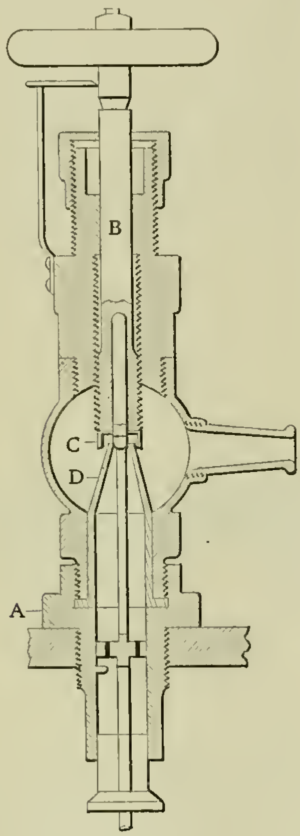
"The most important advantage of hanging the brakes in the manner described is the increase in the stopping efficiency whenever it is necessary to stop as expeditiously as possible—in other words, in an emergency. Unfortunately I have not had the time to make such tests as I hoped to have made before this meeting, in order to get specific data as to how much advantage may be realized in this way; but it is certain, from such experiments as have been made, that from 10 to 15 per cent. shorter stops can be made by simply hanging the brake-beam between the wheels with a proper inclination of the hangers, than can be made by hanging the brake-beams outside in the customary way, and this without any greater danger of sliding the wheels. In the case of a train running at a speed of say sixty miles an hour, this would amount to a saving of somewhere between 200 and 250 feet, which, in an emergency, might easily mean the difference between safety and perhaps the loss of the whole train. This feature and the other features mentioned have appealed to a considerable number of railroads which have already adopted this method of hanging brakes, and I have no doubt it will soon come into quite general use. The fact that it is not patented, and that it does not cost any more to put the brakes on cars in this way, and that it gets rid of several troubles and makes the brakes so much more efficient, will hardly fail to appeal to most railroad managers."

The Pennsylvania lines west of Pittsburg, in their shops at Columbus, O., are building three baggage cars without platforms. If the change works successfully, it is the intention of taking the platform off baggage cars belonging to the company. The Master Car Builders' Association have favored the building of baggage and express cars without platforms for some time.

A Safety Gage Cock.

Much attention has been devoted to the end of making boiler connections in the cab of a locomotive proof against the escape of steam in case of wreck, and among efforts in that direction is the gage cock recently patented by E. E. Kerns, of Bradford, Pa.

The sectional view shown in this connection gives all the vital points of the device so clearly that few words are required to convey the intent of the designer. A bushing A is screwed into the boiler and is threaded to receive the body of the cock. The stem B is recessed at the inner end to receive the shank of the valve C, the latter being made to seat upon and close the end of tube D when the stem B is run inwardly. In this position, as shown in the engraving, the steam from the boiler is cut off.



SAFETY GAGE COCK.

A seat for the check valve E is formed on the inner end of bush A, which is operative when the valve C is raised from its seat, which allows valve E to close and shut off steam from the boiler, and this action would take place in the event of breakage of the cock from the boiler head. The lengths of the stems on the valves are made so that both valves cannot be closed at the same time, and a spring is secured to the body of the cock and made to engage with a groove on the stem B to indicate when both valves are wide open in trying the water. This construction is seen to also favor the removal for cleaning or repairing of the parts outside of the boiler while steam is on—provided scale does not interfere with such a move. However, the safety features are the ones we are interested in primarily. If the check will close at all in a smash it is a move in the right direction.

A short time ago, we made some mention of a catalog issued by H. K. Porter & Co., Pittsburg, Pa., illustrating their light locomotives. The catalog contains an excellent treatise on compressed-air locomotives for mining and other purposes. In this respect it is the best we have ever examined, and will constitute a very convenient hand-book of information for people who have anything to do with the operating of pneumatic machinery. There is a section on Tractive Force, giving the methods of calculation and a variety of experiments. Hauling Capacity is the subject of another useful section, which includes percentage tables for computing the power of locomotives. Track Matters occupy considerable space, and information is given that will be highly useful to people laying track in places where engineering directions are not to be secured. This is often the case in the laying out of railways about plantations, in logging districts and in some mining districts. The methods of laying out curves are given, and a great deal of very useful information. The catalog from beginning to end is replete with useful information, and it ought to be in the hands of every person interested in operating motive power for light railways.

It is surprising on what small foundation a big and sensational story can be reared. There have been paragraphs lately passing through daily papers over a vast territory intimating that the Central Railroad of New Jersey intended discharging all engineers who are over fifty years of age, the axe to begin falling on the first day of the year—a sort of New Year's treat for all concerned. The entire foundation for this yarn was that an engineer, eighty-six years old, was given lighter employment a few weeks ago.

The editorial force is well equipped for turning out copy during the current year, having received the annual supply of pencils from the Joseph Dixon Crucible Co., Jersey City, N. J. Some of the pencils are unusually picturesque, and our only fear is that their influence may incline our editorial writers to produce matter a little too ornate for a staid engineering paper that has passed its tenth birthday.

Plain Talks on the Injector.

BY FRED H. COLVIN.

These articles are not intended as a scientific treatise, but rather as a series of plain talks on injectors, in which it is hoped some of the information gained by several years' experience in making, testing and repairing them may be imparted. The best book we know of, dealing with the scientific side of the question, is "The Theory and Practice of the Injector," by Strickland Kneass, and we heartily commend it for any in need of such a book. This is intended more as a supplement to that, than as any attempt to supplant it.

Injectors may be divided into several classes, the principal ones being:

- Single set of tubes,
- Double set of tubes,
- Adjustable and self-adjusting tubes,
- Fixed tubes,
- Open overflow,
- Closed overflow.

And these can again be subdivided into:

- Restarting,
- Automatic,
- Lifting,
- Non-lifting.

The first injector was invented by Henri Giffard, a French engineer. It was of the open-overflow, adjustable type, as shown herewith.

The principal details have undergone many changes since then, some of which have not been improvements. Every principle for a perfect working injector is clearly shown in the patents of Giffard, which shows that the subject of injectors had been well thought out by him before the world realized that such an apparatus was possible. The exhaust injector, being in a field of its own, will not be considered now.

A closed overflow is one that is closed by hand after the injector is started and remains so until again opened by hand.

An open overflow is one that automatically opens when water or steam flows through the injector but closes (usually by gravity, though in some cases by a light spring) when the injector gets to work. Its only use in open overflow injectors is to prevent the air being drawn in, slightly cooling the water and making a disagreeable noise.

This feature is used by some engineers to put boiler fluid into their boilers without dumping it into the water supply tank or attaching to city water supply. By simply removing the overflow valve disk and placing the overflow nozzle in a shallow dish holding the fluid, the fluid will be drawn into the injector and forced into the boiler without any difficulty.

The open overflow has the advantage of showing at once when the injector "breaks" or ceases to work as it should. There are cases in locomotive work, however, where the overflow is piped so that it cannot be seen by the engineer, thus entirely destroying its advantage over the closed overflow.

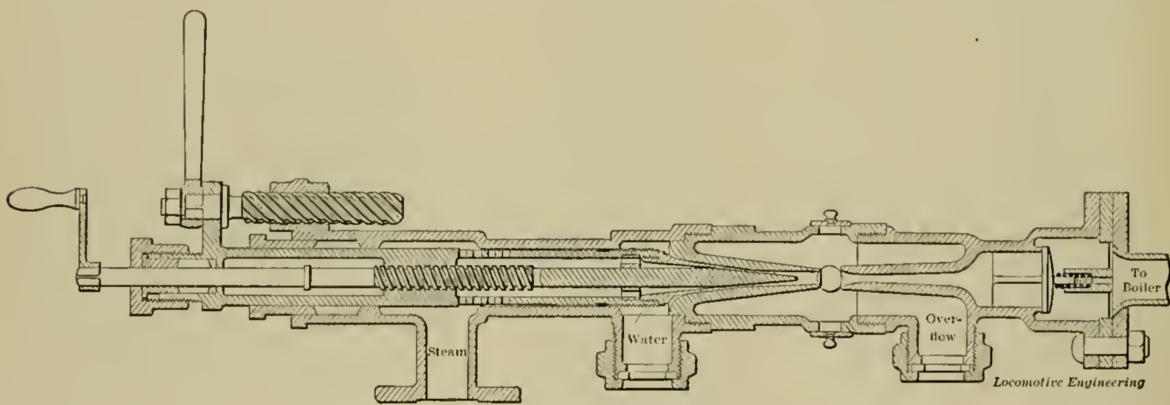
The use of the fixed nozzle or non-adjustable tube injector is constantly increasing as shown by the number of restarting and other fixed tube injectors now on the market.

The fixed nozzle or tube type is somewhat different. There is no way of regulating the water supply except by the water valve in the pipe (few of the leading injectors having special valves for this purpose now), but, owing to the construction and proportion of the tubes this is seldom necessary, as they will handle quite a wide range of both water and steam without difficulty. With extreme water pressure it may be necessary to throttle it, but this seldom occurs. The combined action of the two jets, the central one and the auxilliary annular jet, giving a particularly flexible action, if such a term can be used. They will not, however, handle as wide a range as the adjustable tube injectors and cannot, from the nature of things, notwithstanding the various claims of some makers.

With this type of injector the overflow is usually situated in an overflow pipe, at any convenient point between the injector and boiler. This is often controlled by an ordinary globe valve, which must be open before starting the injector, and the outlet to this should be visible, although the sound will help greatly after becoming accustomed to it.

TO START.

Having the overflow valve open, turn on the water supply as before and open the steam valve slowly. The hot water will commence to rush out of the overflow, as this is the line of least resistance. After the steam is turned on full, begin to close the overflow valve slowly, and as the valve becomes nearly closed, the familiar hum will begin, reaching its maximum when the overflow is fully closed. The water is now going into the boiler, as there is no other outlet for it. To stop, simply shut off steam and open overflow valve ready for the next start. A "break" in the operation is indicated by a cessation of the regulation "hum," a snapping of the steam and water in the pipes, a rapid heating of pipes and injector, and, if the water supply is drawn from a tank, by the noise and possibly spraying of the water therein.



GIFFARD INJECTOR AS FIRST MADE BY WILLIAM SELLERS & CO., 1860.

RE-STARTING INJECTORS.

These are comparatively few in number, so far as types go, although many thousands have been sold. They are not, however, so widely used in large steam plants and similar places as the regular types, but seem to be most in demand for yachts, traction and portable engines, for which they were, in fact, originally designed. Their object is to prevent a possibility of failure, by automatically starting after the water supply has been broken, from the farm engine or yacht lurching, or any similar cause. This necessitates the combination of a lifting jet, so as to lift the water to start with, and is very neatly accomplished by several makers. The writer has repeatedly tested injectors of this type by shutting off the water supply for several minutes, until both the injector and feed water were quite hot, and on opening the feed valve they would start readily. They are, however, of comparatively sensitive construction, and it has been the writer's experience that they do not meet the general requirements as well as the regular types, although he does not wish to condemn any make or antagonize any of the makers. His conclusions in this respect are borne out by the experience of many other practical engineers.

Automatic devices have been used on boilers, for starting and stopping the injector, by a float in the boiler. For this work, a restarting injector is especially adapted, but it is not a practical method in many cases.

While there are occasionally conditions in locomotive practice which are not often met with in stationary practice, still the general action is the same and the causes for failure are practically the same in each case.

Generally speaking, an injector will work when its tubes are in fair condition and it has a sufficient water supply.

The main cause of breaking is insufficient water supply from some cause or other. Briefly, and without regard to theory, the action of the injector is as follows: The water flows up the supply pipe (either by an outside pressure or by the action of a lifting jet) and through the combining tube to the overflow. The steam, entering from the steam tube, is condensed by the water in the combining tube and forces it through the tubes with sufficient pressure to overcome the pressure in the boiler, and, lifting the check valve, forces its way into the boiler.

When these conditions do not exist the injector "breaks," usually from the water supply not being sufficient to condense the steam. In this case the injector "breaks" and all the pipes become hot. Should the water be much in excess of the required quantity the injector will start as usual but will not always force into the boiler as there is more water than can be handled by the steam.

In starting an injector having an adjustable valve in the water supply, either by moving the tubes together or by a separate valve outside, it is a good plan to give an excess of water rather than an insufficient supply, as the water supply can be readily reduced and the injector started to work without any annoying delay due to heating of pipes or water.

The act of starting (with a non-lifter) is simply opening the water valve until water shows at overflow and then opening steam valve, preferably by an easy, gradual movement.

With a lifter, the lifting jet is first opened (either separately or together with the main steam valve as in some injectors) until the water shows at overflow as before, then the main valve is opened until the steam "picks up' the water. If any water shows at overflow after injector is working, the water supply should be reduced slightly, or until the overflow ceases.

Should the steam pressure fall, other conditions remaining the same, water will again appear at overflow, there being more than is needed to condense the steam and more than it can handle. This will not cause it to break, however, but will merely cause waste of water, which is a serious question in some cases. Should the steam pressure increase materially, there will not be enough water to condense it, and steam will show at overflow, and if the rise in pressure continues the insufficient water supply will not be able to take care of the steam, and unsatisfactory working or breaking will result. The injector will also become heated and add to liability of breaking as well as delay starting again. If the tubes are adjusted to this new condition before the breaking point is reached there will be no trouble. The same difficulty will be experienced if the water supply is decreased with pressure remaining the same, which sometimes happens from the supply pipe being partially choked by foreign matter, such as waste, wood, coal, etc. The writer has seen an injector condemned when it was literally filled with small particles of coal and wood which had come in from the supply pipe. In another case the engineer, who had evidently been "seen" by a rival injector salesman, had filled the supply tank with fine coal screenings, which completely blocked the tubes. He was informed that the instrument was an injector, not a coal conveyor.

Various steam pressures require different amounts of water, and the higher the steam the more water is necessary to condense it in the mouth of the combining tube.

Stopping the injector is simply the reverse of starting.

No matter which make of injector you select, it will be better for all concerned to state the exact conditions under which the injector must work, and then let the maker send the one best suited to your case. If the injector then fails to meet your requirements, you can send it back and feel justified in doing so.

One of the first essentials in connection with injectors is the piping, and that will be considered next.

The Grand Trunk Shops at Montreal.

The management of this road is as earnestly engaged in the matter of air equipment on their power as other roads, and from the fact that the provisions of our Interstate Commerce act do not apply to a very large percentage of their power, the conclusion is forced that they are actuated by a very different sentiment from that moving some of the corporations on this side of the line, with reference to safety appliances, who are even now making a last effort to defer the inevitable.

Owing to the very excellent facilities for doing work in these shops, there are few things they cannot manufacture cheaper than they buy, especially when a little incubus like customs duty is considered. Westinghouse 9½-inch pumps are bought finished, but brake cylinders for engine and tender, auxiliary and main reservoirs, and all fittings for the brake are manufactured at the shops.

In boring brake cylinders, it was found to be a slow job to bore them singly, and a lathe boring bar of an ingenious character was devised to double the output. A cast-iron frame to hold two cylinders, with their axes in the same plane and parallel to the lathe centers, was made and bolted to the lathe carriage. The boring bars were then made to be carried in a frame, with a distance between centers equal to that of the cylinders. Rotary motion was given to the bars by means of a gear on the face plate of the lathe, the gear driving a train of gears connecting with each bar. The scheme is not expensive, and served the purpose well for boring, and also facing the joints.

All the working joints of brake levers, pins and rods are case-hardened; this is a requirement so seldom met with in brake practice that it is worthy of more than passing note, for the reason that any improvement in the condition of brake-rod joints improves the efficiency of the brake as a whole, and since hardening the wearing surfaces prolongs the life of the parts, hardening ought to be a good thing. The pin fits as ordinarily made on a braking system are, it seems to us, open to criticism, in the matter of initial lost motion. An allowance of 1-32 inch between pin and hole is not needed; the limit can be made closer than that, and should be.

Blacksmithing is reduced to a science in these shops, and it is not necessary to say that the reduction is due to management. Comparisons are "odorous," and sometimes breeders of heartburnings; but we only do simple justice to this smithshop when we say it is the cleanest one we were ever in. The fullest value is attached to the importance of labor-saving by means of dies. Of the latter, the pivoted die used on the bulldozer—a home-made product, by the way—to shape spring yokes, forms the yoke, and bends the ends over for lugs at one movement of the machine. Money is spent freely on dies, with full confidence in a return; if a machine or tool is needed, it is designed and built. As a matter of fact, it has always been the policy of this road to make everything it used, buying little except the raw material, and this has been carried out to a degree most surprising in extent; even the wire nails used on the system are manufactured here by machines designed and built at the shops. It is said that these machines can compete in price and quality of work with the regulars, and an inspection of them in operation leaves no doubt that the claim is well founded.

A rolling mill is a feature unusual to a railroad shop, and the one connected with this plant is of such magnitude as to arrest the attention of a railroad man at once. All bar iron used on the road is rolled here, in every conceivable size and shape, structural, and also for continued working. Few mills are better equipped than this, the result of slow accretions to satisfy the conditions of environment peculiar to location.

Peerless Hose Nipple Cap.

This little device was invented by Mr. C. H. Dale, president of the Peerless Rubber Manufacturing Company. In investigating the cause of failure of air-brake hose, it was ascertained that about

WESTINGHOUSE AIR-BRAKE NIPPLE AFTER PEERLESS HOSE NIPPLE CAP IS APPLIED.

NIPPLE CAP.

90 per cent. of the hose of all makes failed at the end of the iron nipple connecting the hose to the train pipe. Mr. Dale has been working for the past five or six years to overcome this weakness, and finally struck the idea of a cap for the nipple, and has been several years perfecting the device, as it was a more delicate job than would appear on the face of it without making a change in either the nipple or hose.

The tests show that the iron nipple covered with this rubber nipple cap will outwear from 45 to 55 per cent. the hose that is coupled on the iron nipple, owing to the friction being rubber in both hose and on the nipple, as against the rubber lining of the hose and the harsh end of the old iron nipple.

In putting the hose on, it is necessary to coat the nipple with rubber cement, so that the hose will slip on easily. The mechanical motion is what has ruined the hose by coming in contact with the harsh end of the iron nipple, but with this soft cushion at the end of the nipple, the aforesaid objectionable features are overcome. In addition to this, it makes a very tight packing for the joint. However, nothing is claimed for the packing portion of it; it is simply for the frictional contact that prolongs the life of the hose.

We understand that the material is sold by the gross, and the patentee says it will increase the life of anyone's hose. The Peerless Rubber Manufacturing Company, of 16 Warren street, New York City, has the sole license to manufacture these goods in the United States. The nipple is covered by very broad patents in the United States, Canada and Europe. The cost of these nipples, as we understand it, is about ten cents each. They will, however, make a great saving in the life of air-brake hose, and Mr. Dale is of the opinion that it really should have been called the Good Samaritan instead of the Peerless Hose Nipple Cap.

A Single Piece Ash Pan.

An ash pan of ¼-inch steel plate in one piece, and without rivets, is the standard construction for that fire-box appendage on the Minneapolis & St. Louis Railroad. The pan is brought to form in the flange clamps, the sides at the top being flanged so as to fit up under the mud ring and bolt to same as in the old one made up of divers sheets and angle irons.

A flange is turned over at the front and back of the bottom portion to form a seat for the dampers. Taken as a whole it makes an ash pan more nearly indestructible than the built-up type, does not get out of shape, and is therefore tight. With these advantages supplemented by a less cost than for the old style of pan, Master Mehanic Tongue is satisfied that it is the cheapest pan from every point of view.

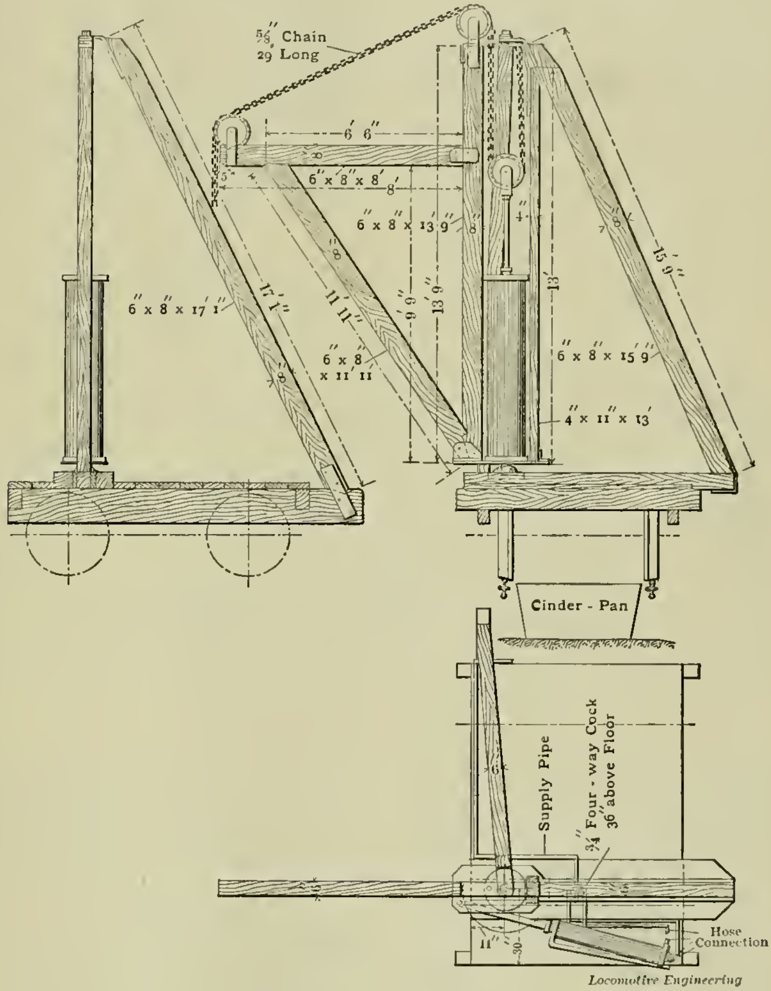
There has probably been no one reprehensible practice in locomotive work any more persistently followed than that of making thin, warpy ash pans, which are always getting out of shape and leaky as a riddle. The solid pan defies every attempt on its integrity and remains square under all circumstances.

Handling Cinders—Missouri Pacific Railway.

The problem of getting cinders out of the way quickly and at a low cost, at division terminals, has been a live one, and one that has been attacked from different points, with more or less success. The Missouri Pacific has reached a solution of the situation; nothing like the well-known pits, however, with their smoking and steaming piles of refuse.

Their system embraces a track which is raised about 30 inches above grade, and under this track is placed a number of wrought-iron pans, 22 inches deep, 48 inches wide and 49 inches long. Engines are run on the raised track, and ash pans are hoed into the pans under the track, until all are filled, when a small four-wheeled car, carrying a crane operated by a 13-inch air cylinder, is run over the filled pans, and the crane quickly lifts and dumps them into a cinder car on an adjoining track.

Our engravings show details of these pans and of the crane, from which their operation will be clear with a word of explanation. The pans have a pair of trunnions at each end, around which passes the lifting chain; the trunnions carrying the load being placed so that in raising of the pan there is no tendency to tip. The dumping of the load is done by the trigger shown in connection with the chain. The jib and load is turned toward the car to receive the cinders, as shown in the front elevation, by means of a 6-inch cylinder lying on the floor, and pivoted at its rear end, as shown in the plan. The two movements necessary to lift and dump the pans are therefore made by manipulation of valves on the respective cylinders, and are done with remarkable rapidity.



CRANE FOR CINDER PIT.

The work is said to be done cheaply by this method; but that statement is too vague to have any meaning to one in a comparative mood. After witnessing its operation, however, and making a mental comparison of the cost and attendance of the pit, and subsequent handling on cars, the balance is in favor of this system. It is cleanly and utterly without any suggestion of inferno in its surroundings, because the cinders cannot be deposited anywhere except in the cinder car.

Electricity on Trunk Lines.

Under the title of "The Enormous Possibilities of Rapid Electric Travel," two electrical engineers attack the problem of connecting New York and Philadelphia by an 85-mile route and 36-minute service.

Despite the fact that leading engineers who favor electricity for short and frequent service with light trains, do not urge the attempt to equip trunk lines with the present apparatus, the authors of this article claim that the equipment in use to-day is sufficient to handle the problem. The third rail is advocated as the means of conveying current, but it is proposed to raise this above the track level.

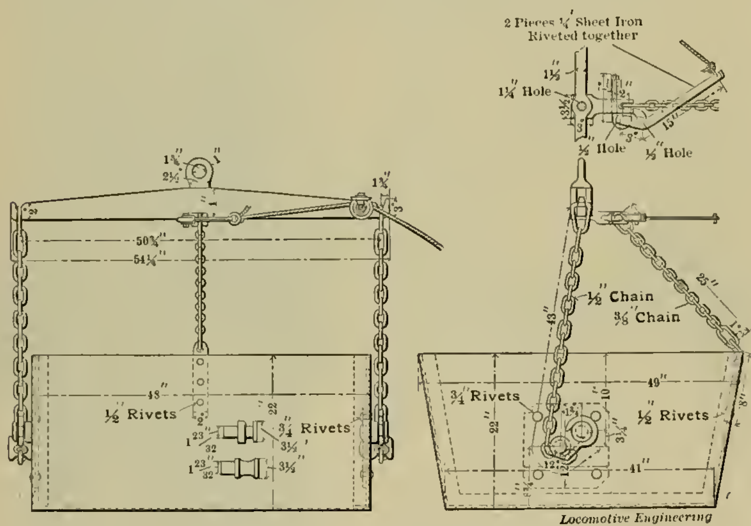
It is proposed to use 7-foot wheels and axle 15 inches in diameter, with a bearing 10 inches long. This at 680.4 revolutions per minute makes 2,670.6 feet per minute for surface speed of axle, which is over four times the surface speed of bearings under the average car with a 4¼-inch axle and 36-inch wheel at 60 miles per hour, or over 25 per cent. greater speed at 170 miles per hour, the same as the proposed road is to run. Add to this the heat generated in the armatures of the motors and transmitted to the axles, and the question of hot journals, which is one of the bugbears of high speed to-day, would probably be an ever-present quantity.

A great mass of details is presented, showing much careful thought on the part of the authors; but there are several points which seem to be open to criticism from the commercial point of view.

The maximum power necessary is taken at 30,000 horse-power per train, which is probably as good an estimate as can be made, and is also a fair one from any standpoint; but when it is considered that there are eleven power-houses, each with a maximum capacity of 30,000 horse-power (20,000 horse-power, nominally), the cost of power plants and of power is something of an item.

The cost of the conductors for current, the loss between engine of power and motor, all must be considered, until it seems almost a maxim that there is little hope of supplanting the locomotive for through trains on trunk lines as long as the current must be generated by a steam-driven dynamo.

The modern dynamos and motor have efficiencies, under an economical load, of from 80 to 95 per cent., so that there is little to be gained in this direction.



DETAILS OF PANS FOR CINDER PIT.

The steam plant will probably be more economical than any locomotive, but whether the difference will be sufficient to make it economical is a very doubtful question. We think not.

The proposition to run trains between New York and Philadelphia at intervals of two minutes, is startling in its progressiveness; but it does not seem likely that the mere running of more trains will increase travel enough to warrant this extra expense. We might run a train a minute between some towns and have them empty, save for a few who ride for idle curiosity. It is the transaction of business between cities which calls for more trains, and when this increases, more trains will be forthcoming. But the mere running of trains will not materially increase it; the business between the cities must come first. There are many other points which might also be criticised, but we forego it at present.

We do not propose to say the plan is impossible, for the word "impossible" is a dangerous one to use in these days; but we venture to say that such a road will not be started for some time to come.

The Wisconsin Central has in contemplation an extensive purchase of new power, both passenger and freight. An order has already been placed with the Brooks Locomotive Works for ten heavy 10-wheel engines, the order being equally divided for freight and passenger. These engines, we are informed, will be perfect models in design. They will have Belpaire boilers, 66 inches in diameter; the cylinders for the freight engines 20 x 26 inches, and those for the passenger 19 x 26 inches. The drivers will be 63 and 69 inches diameter respectively. Our advices concerning this power convey hints of some modern and very novel features that will command the attention of admirers of original work and thought in locomotive design.

The Davis & Egan Machine Tool Co., of Cincinnati, report continued improvement in European trade. The new addition to this company's works is now running full. They are working 12½ hours a day in each plant, and several departments are working all night. Among recent orders received by this firm is one from Yarrow & Co., the well-known ship builders, of London. They also have received orders for several combination turret lathes for the Netherland Government.

The Pennsylvania Railroad Company has now over 90,000 freight cars equipped with the automatic coupler, and 60,000 with air brakes and automatic couplers. All the locomotives of the company, which number about 3,700, are equipped with the automatic air brake, and all the passenger cars, numbering about 4,000, have both the automatic coupler and air brake. All the new cars which the company has constructed for some time past have been equipped with both the automatic coupler and the air brake.

The Brooks Locomotive Works have completed a six-wheel 14 x 20 side-tank mogul for the Seoul-Chemulpo Railroad of Corea. It is one of an order of four, and will be the first locomotive ever seen in Corea. It weighs about 78,000 pounds and is of American standard gage. It will be taken overland to Seattle and shipped from there to Corea.

G. & H. Barnett Co., of Black Diamond File Works, Philadelphia, received the reward of a silver medal from the Nashville Exposition, for the excellence of their goods. This was the only award given for the character of goods exhibited, which is highly complimentary to the firm.

A Novel Banquet Hall.

The Seaboard Air Line Railway built a monster passenger car at Nashville, for the Tennessee Centennial Exhibition. This car is 102 feet long, 20 feet high and 24 feet wide, with wheels 6 feet in diameter. It is a banquet hall on wheels, seating 130 people. It is a two-story affair, the upper part being divided into sleeping rooms for the road's employés visiting the exposition. This car should prove a good advertisement for the road.

"Narrow Gauge Locomotives" is the title of a handsomely illustrated catalog recently issued by the Baldwin Locomotive Works. It is a book, 9 x 6, of 450 pages, and contains illustrations of a great variety of locomotives and locomotive details. It appears to be intended for the use of foreign railroads, which are the principal purchasers of narrow-gage locomotives; but it will be found highly interesting reading for people on the American continent. There is a good history of the locomotive connected with it, showing the gradual development of the engine.

We have lost the greater part of a morning trying to reach the Klondike by means of a puzzle sent out by the Mason Regulator Co., Boston, Mass. We have to confess that the journey seems a little too complicated for us, and any of our readers who consider themselves expert on the solving of puzzles ought to send for this one and explain to the world how the journey is made.

"Fine Mechanical Tools and Milling Cutters" is the name of a very neat illustrated catalog recently issued by L. S. Starrett Company, Athol, Mass. It contains very good engravings, showing a great variety of small tools made by this well-known company. It will be found a very useful reference for machinists and others who like to have a good kit of small tools in their tool box.

The "Confessions of an Oil Fiend," by John Alexander, is the name of a little pamphlet issued by McVicar & Sweet, Equitable Building, Denver, Colo. Its subject is the R. Usher oil can. Like every subject that he puts his pen to, John Alexander has made this pamphlet well worth reading. Everybody should send for it.

Mr. Stirling, locomotive superintendent of the South Eastern, of England, is applying his reversing gear to all his locomotives. This is an improvement very much needed in this country since the weight of valve gear has become so unwieldy that reversing an engine is a hard job for a powerful man.

Gage and Calipers for Wheels and Axles.

Almost innumerable are the adopted methods for the preservation of established shop standards on wheel work, but one of the best of these, if not quite the best, is shown in our engraving of the system inaugurated by Master Mechanic Tonge, of the Minneapolis & St. Louis Railway, the strong points of whose practice lie in the combination cylindrical gages for the wheel and axle fit, and mandrel for turning to size the boring cutters.

The steps marked 4⅝ to 4⅞ inches, inclusive, represent the finished bores of wheels, advancing by sixteenths; to these diameters the inside calipers are made to correspond. The steps at the opposite end of the mandrel are used to fit the outside calipers to, and are therefore turned enough larger than the wheel-fit steps to make the press fit for the axle.

At one end of the mandrel is shown a boring cutter in the position it occupies when being turned to size; this end of the mandrel being an exact counterpart of the bar in the boring mill, as far as concerns the fit of the cutter.

It is seen that the variables in this system are few, but three, in fact, since the steps are not subject to wear, and are thus practically constant in size, leaving all wear to the cutters and calipers. A reference of these to the mandrel brings the straying element back to the fold before any serious departure is possible from the standard, and the latter does what it was designed for—holds them in line. The solid calipers lend a feeling of certainty, more especially in a rush job, for the reason that they eliminate the "personal equation" in allowing for the fit, which, as explained, is all done with the tools. This method of keeping up to standard grows in favor, unlike some others that have been adopted with a grand flourish and afterwards left to droop, from their too apparent inability to get results.

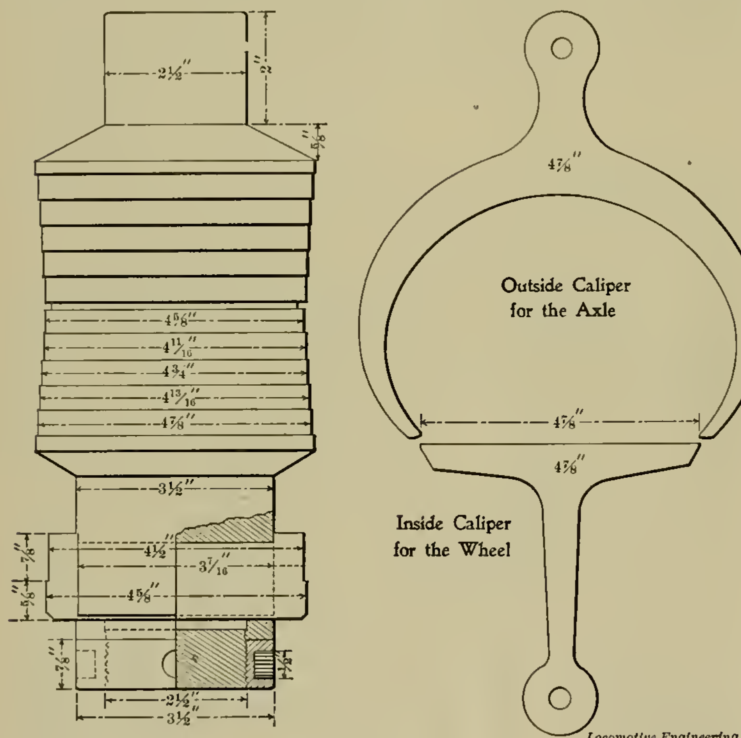


Fig. 1

GAGE AND CALIPERS FOR WHEELS AND AXLES.

The Bethlehem Iron Co. have sent out a neat little pocket folder giving a list of the kinds of forgings made by the company. It also gives tables showing the weight of round steel per running inch from 1-16 up to 36 inches. This table will be found a very useful reference to men who have little time to make calculations necessary to find out the weight of iron.

The Joseph Dixon Crucible Company, Jersey City, N. J., have placed on the market an anti-flux known as "brazing graphite," and repeated tests have strongly demonstrated its value, that it is not too much to say that the next season will, in all probability, witness a complete revolution in brazing methods, the liquid process entirely superseding the others.

Counterbalancing Driving Wheels—Wabash Railroad.

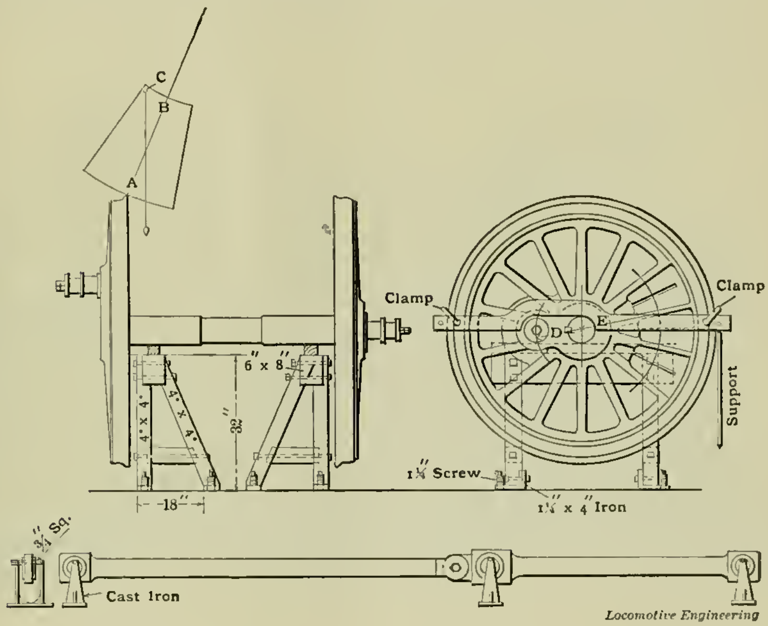
The adjusting of counterbalance in driving wheels is receiving much more attention than was formerly devoted to it, on account of the agitation of the subject that was forced on the heads of mechanical departments by the increased weights and higher speeds of power. There is more or less of an air of mystery surrounding the operation, and the veil is made opaque or transparent in proportion to the facilities in a shop for doing the work.

Superintendent of Motive Power Barnes, of the Wabash Railroad, has a simple way of counterbalancing his engines, and, with his permission, we give the details and drawings of the process. The wheels are placed on the wooden horses and leveled up in each direction, with the side which is to be worked on in the position as shown, so that a line through the crank pin center and axle center will be perfectly level. The rods are attached to the crank pin, the outer ends of the rods being supported so that they will also be level. Weights are then suspended from the pin, such as will represent the proper proportion of reciprocating weight acting upon the wheel. The balance is then completed by adding to, or deducting from the counterbalance.

Each wheel is to be balanced for all of its revolving weight, and its proportion of three-fourths of the reciprocating weight; this three-fourths of the reciprocating weight is to be divided among the wheels in proportion to the revolving weight carried by each wheel.

To find the weight to be added to or deducted from the counterweight, take the surplus or deficient weight as shown at the crank pin, and multiply it by the distance *D*, then divide that product by the distance *E*, and the quotient is the number of pounds to be added to or deducted from the counterweight.

The same results may be obtained without placing the rods on the pin, by clamping a straight-edge to the wheel as shown. At a point equal to three times the distance *D* from the axle center, place a support under the straight-edge, with the lower end resting on scales, and note the weight. Multiply this weight by three, and note the difference between the product and the weight of the rods and reciprocating parts belonging to the wheel. This difference multiplied by the distance *D*, and divided by the distance *E*, will give the amount in pounds to be added to or deducted from the counterweight. In order to retain the center of gravity, the additions or deductions should be made to extend over the whole surface of the counterweight.



COUNTERBALANCING DRIVING WHEELS.

To weigh the rods, place them on supports as shown, with all bolts, keys and oil cups in place, and block up under the supports, so that each block may be removed in turn and the weight at that point taken on scales; the main rod to be weighed in the same manner. To find the center of gravity of the counterweight, make a thin wood template of the balance block, showing the center line *A B*. Suspend the template from any point, as *C*, and where the plumb line from *C* intersects the line *A B*, will be the center of gravity. The revolving weights are the crank pin, the crank-pin hub, the side rods and back end of main rod. The reciprocating weights are the piston and rod, the crosshead and the front end of main rod.

The following is the composition, according to the *Iron Industry Gazette*, of a number of Japanese alloys hitherto kept a close secret, and now revealed by workmen engaged in making them: The "shadko" is an alloy of copper and from 1 to 10 per cent. of gold; the objects are placed in a mordant of sulphate of copper, alum and verdigris until they have assumed the coppered or blue-black hue of sword-sheaths and decorative articles. "Gni-shi-bu-ichi" is a copper alloy with 30 or 50 per cent. of silver of the well-known gray color. "Mokume" is a compound of several alloys. About thirty plates of foils of gold, "shadko," copper, silver and the last mentioned alloy are soldered together, holes are made, the plate hammered out and put in the mordant. The finest Japanese brass, "sinchu," consists of 10 parts copper and 5 of zinc. Bell metals, "karakane," are made of 10 parts of copper, 4 tin, ½ iron, 1½ zinc, the copper being melted first and the other metals added in the above order. Other proportions give inferior bell metals.

The railroads in Great Britain were very slow to adopt the four-wheel truck, or "bogie," as they call it, for carrying the front end of the locomotive; but they are falling into the practice very steadily. About the last railroad to hold out was the London & Northwestern, of which Mr. F. W. Webb, of compound locomotive fame, is the mechanical superintendent. Mr. Webb was greatly in favor of a single pair of leading wheels with radial axle boxes, and nearly all his passenger locomotives are equipped in that way; but recently he has applied the four-wheel truck to a new class of passenger engine, and it is likely to become the standard of the road.

There is something curious about the relation that prices of steel billets have to steel rails in England and in the United States. Steel rails were recently quoted in the English market at $22.40 a ton, and in Pittsburg at $25 a ton. The steel billets from which the rails are rolled were quoted in England at $20.55 a ton, and in Pittsburg at $15.50 a ton.

The Chicago and New York service of the Baltimore & Ohio has been improved by the addition of seven new Pullman cars which the Pullman people say are the best cars they operate anywhere. They have large smoking rooms, large ladies' toilet rooms, empire deck, and all the new features that the company has recently introduced.

The Brown system of discipline without suspension has been adopted by the Erie Company, and went into effect recently. This modern and humane method of handling men is gradually gaining favor all over the country. The description of the system can be had from Locomotive Engineering; price 10 cents.

The Q. & C. Company, of Chicago, have published an illustrated catalog devoted to cold metal sawing machines. There is not much to be said about this class of tool that people interested cannot find in this catalog. We cordially commend its use as a hand-book of cold metal sawing machines.

The Dickson Manufacturing Company and Dickson Locomotive Works have moved their New York offices from 100 Broadway to 40 Wall street, on the tenth floor. They are among the few favored manufacturers who are having all they can do at present.

The Joseph Dixon Crucible Company, of Jersey City, N. J., have issued an illustrated folder on "Pure Flake Cycle-Chain Graphite." It gives interesting facts concerning the care of bicycle chains, and ought to be in the possession of every wheel rider.

The capitalists who have reorganized the Union Pacific have inaugurated their control by cutting down the working time of the force in the Omaha shops from five to four days a week. That is a good way to cultivate socialism among workmen.

Williams & Moore, of Chicago, lately assigned, have sold out their entire interest to the Q. & C. Co., of Chicago. The rail jack known as the Williams & Moore will hereafter be manufactured by the Q. & C. Co. Also the Williams drill.

The Central Railroad of Georgia have just finished the construction of fine new repair shops at Macon, to replace those that were burned some time ago. The intention is to fit them with the most modern kinds of machinery.

The Davis & Egan Machine Tool Co., of Cincinnati, O., have issued a handsome catalog, illustrating and describing their machine tools. It will be sent to anyone interested in this line upon application.

The Atchison, Topeka & Santa Fe are building three very fine postal cars in their shops at Topeka. It is reported the cost of each will be $12,000. They are fine specimens of the car builder's art.

Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock.

[Trade-Mark Registered.]

Vol. XI. NEW YORK, FEBRUARY, 1898. No. 2.

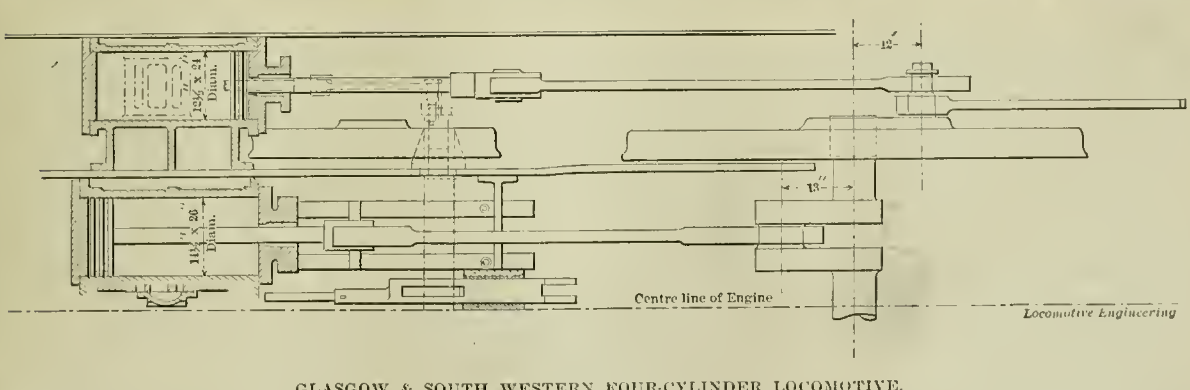
Glasgow and South Western Four-Cylinder Locomotive.

The locomotive superintendents of several British railways have within the last few years designed four-cylinder locomotives, placing two cylinders between the frames and two outside. We hereby illustrate, by half-tone, perspective view and half plan of the running gear of a four-cylinder locomotive recently built by Mr. James Manson, locomotive superintendent of the Glasgow & South Western Railway, at the company's shops at Kilmarnock.

In writing to us about the engine, Mr. Manson says:

"Although the general design of this engine was worked out by me some years ago, when considering the subject of compound locomotives, No. 11 is a high-pressure engine; that is, high-pressure steam is used in all the four cylinders. The engine was turned out of the company's works at Kilmarnock early in April of this year, and has been for some months in regular service working express trains between Carlisle and Glasgow, the distance between these two points being 115 miles. Up to December 2d the mileage run by the engine was 21,147 miles.

With regard to the general features of the engine, there are four cylinders all in line, driving on to one axle, viz., two inside cylinders, 14½ x 26 inches, placed under the smokebox with their connecting rods attached to the crank axle, and two outside cylinders, 12½ x 24 inches, attached to crank pins upon the driving wheels; and as the outside cranks are arranged opposite to the inside cranks, the reciprocating masses balance each other. The valves for the inside cylinders are placed



GLASGOW & SOUTH WESTERN FOUR-CYLINDER LOCOMOTIVE.

between the cylinders, and worked direct from the link motion. The valves for the outside cylinders, which are on the top, are balanced—that is, fitted with a relief ring or piston and actuated by a rocking shaft. By this arrangement only two sets of valve gear are required to work the four valves.

Both engine and tender are fitted with automatic vacuum brake; the regulating valve in the dome is of the double-beat type, and the reversing and notching up of the engine is effected by the steam reversing gear, which has been in operation for many years on this company's engines.

Metallic packing is fitted to the piston rods; sand is delivered in front of the driving wheels by steam sanding apparatus, and the boiler is fed by two automatic re-starting injectors.

Lateral movement is provided for the bogie by a swing link arrangement, and the engine runs with great steadiness at high speed.

The sketch plan sent herewith shows the general arrangement, and a few leading particulars of the engine will be found below:

CYLINDERS.

Outside—12½ inches diameter by 24 inches stroke.
Inside—14½ inches diameter by 26 inches stroke.
Diameter of bogie wheels—3 feet 7½ inches.
Diameter of driving wheels—6 feet 9½ inches (coupled).
Diameter of trailing wheels—6 feet 9½ inches (coupled).
Bogie wheel base—6 feet.
Fixed wheel base—8 feet 9 inches.
Total wheel base—21 feet 11 inches.

BOILER.

Barrel (steel)—
Maximum internal diameter—4 feet 3 inches.
Length—10 feet 6 inches.
Thickness of plates—½ inch.
Diameter of dome, inside—1 foot 10¾ inches.

Firebox casing (steel)—
Thickness of wrapper—½ inch.
Thickness of throat plate—⅝ inch.
Thickness of back—⅝ inch.
Outside length—6 feet 2 inches.
Outside width—4 feet.

Firebox (copper)—
Thickness of plates, at tubes—1 inch.
Thickness of plates, sides—½ inch.
Thickness of plates, back—½ inch.
Inside length—5 feet 6¾ inches.
Inside width—3 feet 4 inches.
Hight at front—5 feet 11 inches.
Hight at back—5 feet 4 inches.
Diameter of copper stays—1 inch.
Number of copper stays—671.

Tubes (brass)—
Number—238.
Length between tube plates—10 feet 9 11-16 inches.
Outside diameter—1⅝ inches.
Thickness at firebox end—11 S. W. G.
Thickness at smokebox end—12 S. W. G.

Heating surface—
In firebox—111 square feet.
In tubes—1,094 square feet.
Total—1,205 square feet.
Grate area—18 square feet.
Working pressure per square inch—165 pounds.
Weight in working order—109,088 pounds."

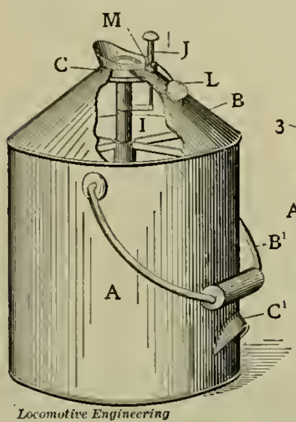


Fig. 1

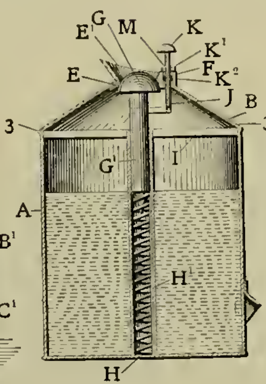


Fig. 2

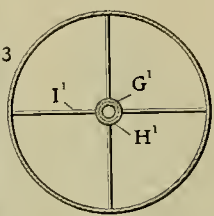


Fig. 3

A NEW SUPPLY OIL CAN.

A New Supply Oil Can.

An oil can that did not waste as much of its contents as it turned to legitimate use, has been such a rarity as to afford a fine field for the inventive talent of the country, and one of the best efforts in the line of improvement we have seen is shown in our engraving of the supply can, invented by Mr. J. C. Hall, a practical man of twenty-two years' locomotive service.

This design has been evolved by concentrating thought on the detail of stoppers; the uppermost idea being to produce a stopper that could not be distorted out of shape, and thus waste oil by a failure to retain it in the can, or one that could not be lost, as is too often the case. In Fig. 1 is shown a perspective view of a can that is believed to possess the good points sought after. The view is broken, so as to show how the stopper is sealed by an ordinary lead car seal *L*, which is passed through a hole in the stem *J*, and thus locks the valve against the fell designs of anyone engaged in making an oil record without drawing supplies from the proper source, as has been done in many well-authenticated instances.

Fig. 2 is a sectional view of the can, which makes clear the functions of the parts. *K* is the packing nut for the stem *J*, and *F* is space for packing to prevent leak around the stem. These parts are formed of one piece with the flared top *E'*, the under side of which is the valve seat *E*. The valve *G* is spherical on its bearing surface, and is held in contact with its seat by a helical spring shown in the tube *H'*, which is held central in the can by the frame, Fig. 3. In operation this can should be positive—and clean. The stem *J* is connected to and a part of valve *G*, and it is plain that when pressure is removed from the stem, the spring closes the valve at once without any waste of oil. This can looks as though it might be a good companion piece for the hand oiler which Jim Skeevers recommended in these columns in November last.

Within twelve months the catacombs of Rome will be illuminated by incandescent electric lights. The Westinghouse Company has received a dispatch from its representative in Rome announcing that he had secured the contract for lighting the catacombs of St. Callistus, St. Agnes, St. Cyraca, St. Demitilla, St. Priscilla and St. Bentianus. Some months ago the subterranean burial-ground of St. Callistus was lighted, and the effect was so satisfactory that the persons in charge decided to have electricity put in all the catacombs of the city. Six dynamos, capable of supplying current for not less than 450 lamps, will be placed in the six catacombs.

A recent decision of the Supreme Court of the United States compels the Buffalo, Rochester & Pittsburg Railroad to remove all the New York air brakes from their cars. Meanwhile the Louisville & Nashville Railroad have within the month placed a large order with the New York Air Brake Company for freight-car brakes. Some people will not believe that a blow from a cannon ball will hurt, until it strikes them.

Schenectady Locomotive for Japan.

The annexed engraving gives the general appearance of one of ten very handsome eight-wheel locomotives recently built by the Schenectady Locomotive Works for the Imperial Government Railways of Japan. They are designed for a railroad having a gage of 42 inches, and are quite heavy eight-wheelers for that gage.

Engine provided with two Coale's 2½-inch safety valves, encased pop (one with relief); Detroit (1-quart) double sight feed lubricator; one "Furness" on each steam chest; Smith's automatic vacuum brake on all drivers and on tender; spring buffers on front of engine and rear of tender, also between engine and tender; No. 3 Crosby 5-inch brass bell chime whistle; Ashcroft steam gage; three headlights, with 8-inch bulls-eye lens.

Greatest travel of slide valves—5½ inches.

Outside lap—⅞ inch.

Diameter of driving wheels outside of tire—54 inches.

Material of driving wheels, centers—Cast iron.

Driving box material—Steeled cast iron.

Diameter and length of driving journals—7 inches diameter by 8 inches.

Diameter and length of main crank pin journals (Cambria steel, Coffin process)—4¼ inches diameter by 4¼ inches.

Diameter and length of side rod crank pin journals (Cambria steel, Coffin process)—3¾ inches diameter by 3½ inches.

Engine truck, kind—Four-wheel, swing bolster.

Engine truck, journals—4½ inches diameter by 8 inches.

Firebox staybolts—15-16 inch soft-rolled copper.

Tubes, material—Solid drawn brass.

Tubes, number—196.

Tubes, diameter—1¾ inches.

Tubes, length over tube sheets—11 feet.

Heating surface, tubes—980.17 square feet.

Heating surface, firebox—93.5 square feet.

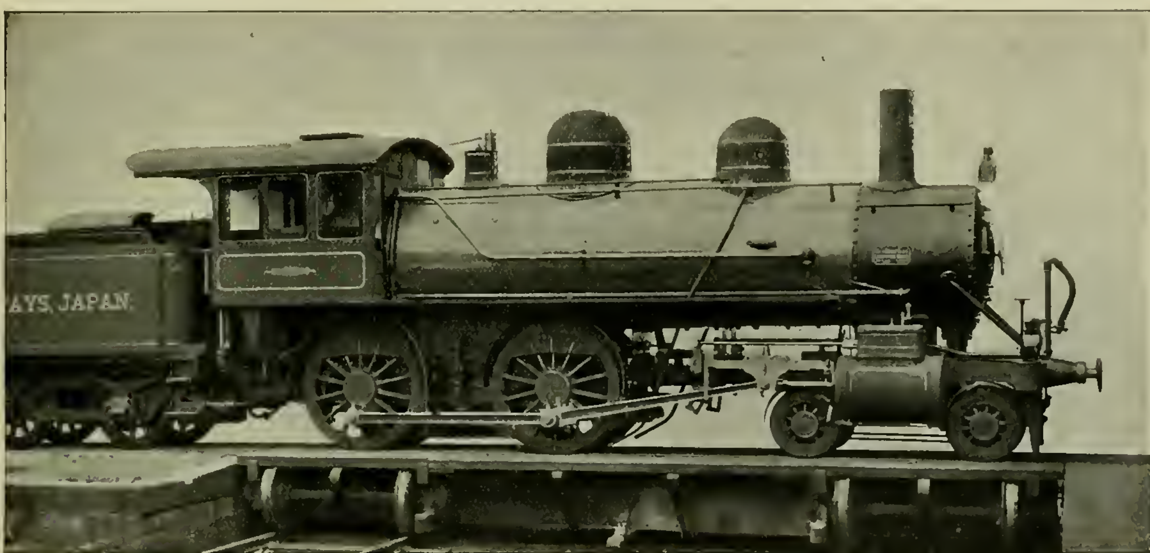
Heating surface, total—1,073.67 square feet.

Grate surface—16.04 square feet.

Two Sellers injectors, Class "N," improved of 1887, No. 8½.

Moved the Mileposts.

When you hear an engineer with an old scrub of an engine telling about making a mile a minute, just tell him about old



SCHENECTADY LOCOMOTIVE FOR JAPAN.

The following are the leading particulars of the engines:

Weight in working order—78,600 pounds.

Weight on drivers—52,350 pounds.

Wheel base, driving—7 feet.

Wheel base, rigid—7 feet.

Wheel base, total—20 feet 10 inches.

Diameter of cylinders—16 inches.

Stroke of piston—24 inches.

Horizontal thickness of piston—5¼ inches.

Diameter of piston rod—2½ inches.

Kind of piston packing—Cast-iron rings.

Kind of piston rod packing—Jerome metallic.

Size of steam ports—14 inches by 1¼ inches.

Size of exhaust ports—14 inches by 2½ inches.

Size of bridges—1 inch.

Kind of slide valves—American balanced.

Style of boiler—Extended wagon top.

Outside diameter of first ring—52 inches.

Working pressure—160 pounds.

Material of barrel and outside of firebox—Steel.

Thickness of plates in barrel and outside of firebox—9-16, ⅝, 7-16 and ½ inch.

Horizontal seams—Butt joint, sextuple riveted, with welt strip inside and outside.

Circumferential seams—Double riveted.

Firebox, length—78 inches.

Firebox, width—29⅝ inches.

Firebox, depth—Front, 55 inches; back, 48 inches.

Firebox, material—Copper.

Firebox plates, thickness—Sides, ½ inch; back, ½ inch; crown, ½ inch; tube sheet, ⅞ inch to ½ inch below tubes.

Firebox water space—Front—4 inches; sides, 2½ inches; back, 3 inches to 4 inches at crown.

Firebox crown staying—Radial stays, 1 inch diameter.

"Dad" Hawley and see what he has to say. "Dad" Hawley was an honest old chap, and wouldn't stretch the truth three seconds to make a mile faster than the other fellow—that's about as hard a test on an engineer as you can find.

All the boys were bragging about how fast they could go, and some mighty fast miles were being made—in the roundhouse. One day "Dad" had his train swinging in good shape and he timed the 91 on a good, level stretch. When he got back he told of it about as follows: "Tried the 91 to-day, boys, along the meadows out yonder, and what do you think she did?" Immediately everyone began telling how fast he had run that particular mile, but "Dad" went on: "Had her swinging in good shape, and so I pulled my watch and took time by the twenty-third mile post. I kept a watchin' her close, and the 91 did everlasting hum across them meadows. Well, boys, the second hand chased around pretty clost to the minute, and I began getting anxious for that next mile post.

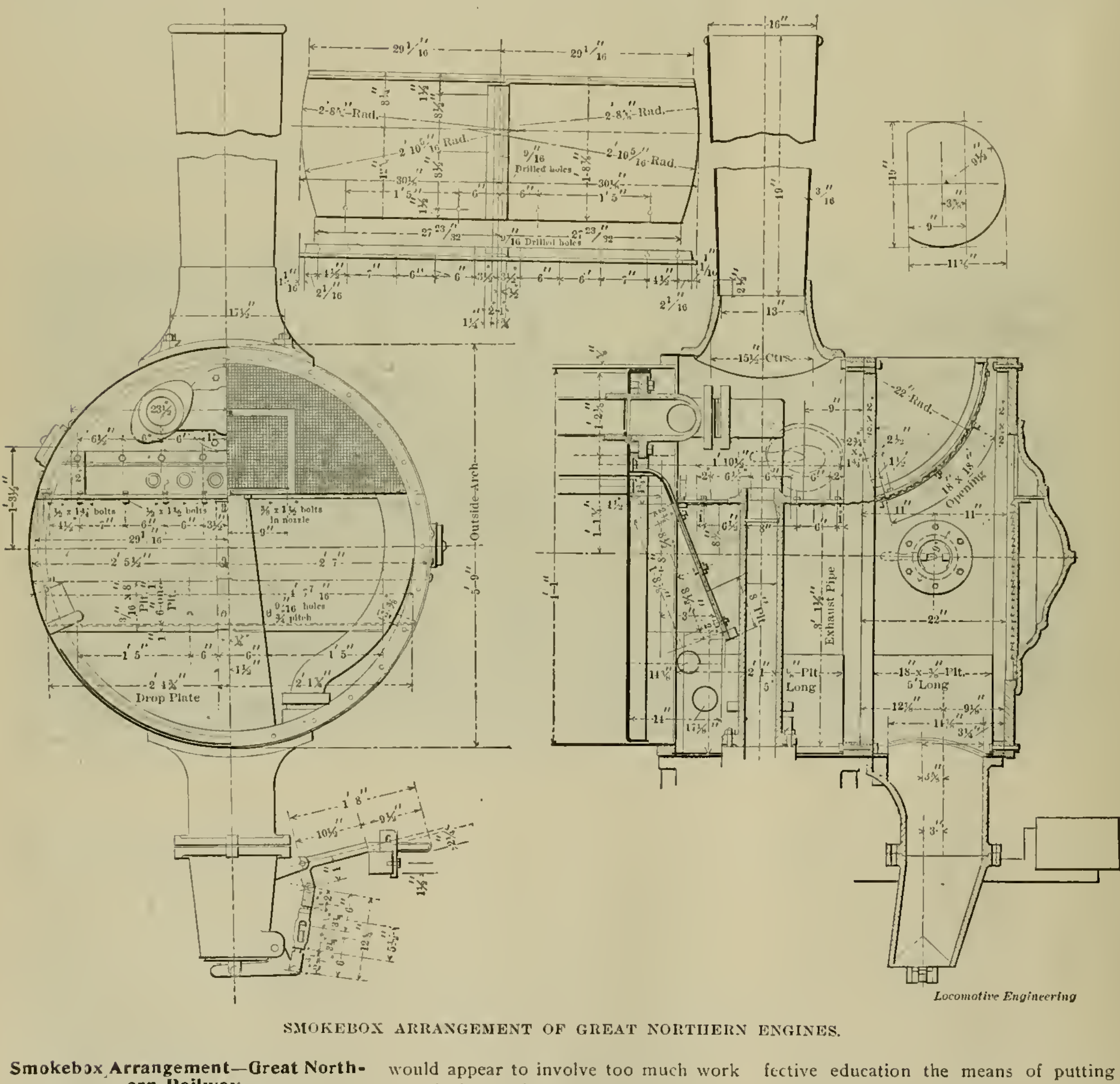
"Do you know, boys, some white-livered sardine had moved that mile-post so I didn't get to it till 19 seconds past the minute! Durn mean trick, I call it," and the boys didn't exactly know whether "Dad" was making fun of them or thought some one had fooled him.

There are a good many fast miles made the same way.

above the top row of flues, to which the netting and deflector plate is attached, and which gives the latter a constant angle with reference to escaping gases, in all engines of a given class; when made right for the proper steaming of one, it is right for all.

The deflector has the usual adjustable diaphragm, but not with the slotted holes. Any change in position must be done by changing the diaphragm to a higher or lower hole for any great movement. This

We understand that the International Correspondence Schools, Scranton, Pa., are adding pupils at the rate of about 2,500 a month. They now have about 30,000 students on the list whose studies are unfinished. Some students go through very rapidly, while others work for years before finishing the course. This is undoubtedly one of the most useful educational institutions ever organized. It gives the ambitious mechanic with a de-



SMOKEBOX ARRANGEMENT OF GREAT NORTHERN ENGINES.

Smokebox Arrangement—Great Northern Railway.

The extension front and all the details connected with its interior arrangement, shown herewith, is the standard of the Great Northern, as devised and brought to its satisfactory state of efficiency by Superintendent of Motive Power Pattee.

There is no claim of originality in the application of the netting, but there are some things that will be worth considering, among which is the cast iron hood would appear to involve too much work to make it an object to "monkey" with the draft appliances to any very serious extent, except within a small range.

One of the best features of the cinder attachments is the pulverizer on the inside of the front end door. It is a casting with the inside face heavily corrugated; its object being to break up cinders that may go up against it, and render them powerless for harm if by any chance they should reach the outside of the stack.

fective education the means of putting himself upon an even footing with the college graduate. We consider it of greater value to our industrial world than many of the technical colleges that make much pretentions of their usefulness. Among the instructors recently added to these schools is Mr. H. Rolfe, an English mechanical engineer of railway training of commanding ability, who has occupied several good positions in this country within the last five years.

Cooke's Oregon Short Line Locomotive.

The locomotive here shown is one of two consolidation engines recently built by the Cooke Locomotive and Machine Company, for the Oregon Short Line, and designed by Mr. J. F. Dunn, superintendent of motive power. The engines are intended for working on heavy grades and are very powerful, besides having unusual steam making capacity.

The cylinders are 21 x 28 inches; driving wheels 51 inches diameter, and the steam pressure carried on the boiler, 185 pounds per square inch. This gives the engine a little more than 40,000 pounds of tractive power. That, in connection with the boiler which provides 2,313.7 square feet of heating surface, is likely to produce a very economical engine. There is a considerable amount of selected material used in the construction of the engine. The centers of the main driving wheel are steel, the eccentric straps and a variety of other parts malleable iron. The steam pipes and driving boxes are of cast steel. Taylor iron is used to a great extent for parts subjected to much strain.

One extraordinary thing about the engines is that screw threads different from the United States standard are used; from ¾ diameter up to 1⅞-inch the screws are ten threads to the inch. All those screwed into the boiler are 12 threads to the inch.

Total weight in working order—164,000 pounds.

Total weight on drivers — 148,000 pounds.

Total weight on truck—16,000 pounds.

Loaded weight of tender — 107,000 pounds.

Total wheel base of engine—22 feet 3 inches.

Driving wheel base—14 feet.

Wheel base of engine and tender—52 feet 6¼ inches.

Cylinder—21 x 28 inches.

Driving wheels—51 inches diameter.

Engine truck wheels—30 inches diameter.

Driving axle journal—8½ x 11½ inches.

Engine truck axle journal—5½ x 10½ inches.

Boiler, type—Straight top.

Boiler, working pressure—185 pounds.

Boiler, diameter first course—72 inches.

Boiler, firebox length—120 7-16 inches.

Boiler, firebox width—40¾ inches.

Boiler, mud ring—Double riveted.

Boiler, tubes, number—270.

Boiler, tubes, diameter and length—2¼ inches diameter, 13 feet 6 inches long.

Boiler, thickness of shell—¾ inch.

Boiler, heating surface tubes—2,133.8 square feet.

Boiler, heating surface firebox—179.9 square feet.

Boiler, heating surface, total—2,313.7 square feet.

Boiler, grate surface—34.08 square feet.

Slide valve—Richardson Allen.

Slide valve travel—6 inches.

Steam ports—16 x 1⅝ inches.

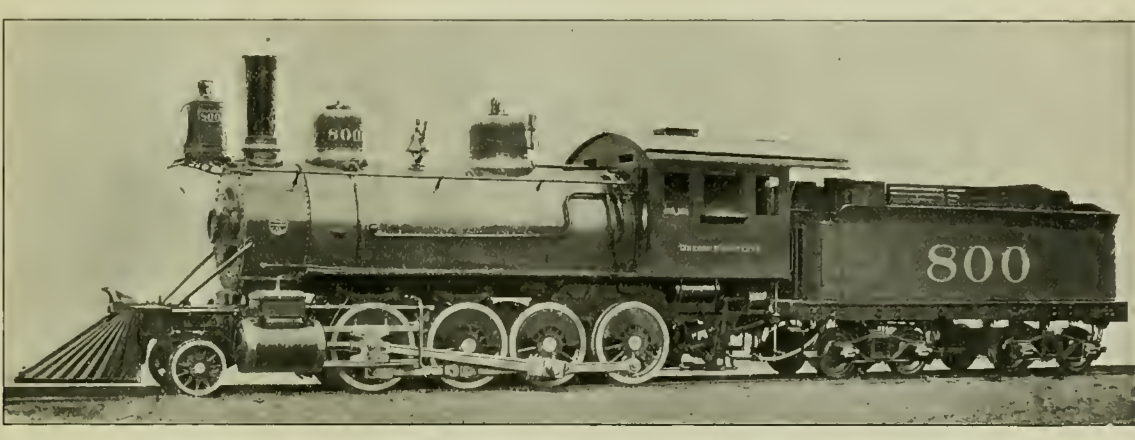
Exhaust—16 x 3¼ inches.

Lap—1 inch.

Exhaust pipe—Double.

Smoke-box netting—Perforated plate.

Center of boiler from rail—7 feet 9 inches.



COOKE CONSOLIDATION FOR OREGON SHORT LINE.

Plain Talks on the Injector—II.

By Fred H. Colvin.

THE PIPING.

In connecting an injector up for working it is well to study the directions given by the maker as to size of pipe and location of overflow. Always use as large a pipe as the list calls for, and if they are of necessity over 10 feet long, it will probably be better to use the next size larger, but make it a point to have the connection as short and as direct as possible.

Take steam from the highest part of the boiler to insure its being dry, and do not connect into the steam pipe of engine for the same reason; a sudden demand for steam may lift water into the steam pipe and cause the injector to "break" or stop working.

Have a good check valve between the injector and the boiler. A leaky check valve is a constant source of annoyance, and has caused many an injector to be condemned from no fault of its own. The writer's experience has given a preference to a vertical lift check rather than a swinging one, as the latter seem to wear the most at the lower part of the seat, and thus get to leaking sooner than the others. However, be sure the check is tight, regardless of its type, and watch it to see that it doesn't get to leaking and annoy you.

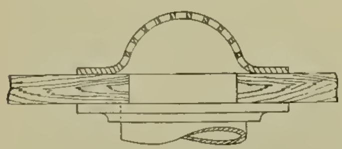
In connecting up the pipes, particularly with small sizes, be careful about screwing the end into a valve or fitting, such as an elbow, so as to restrict the size of the passage through it. This is a fruitful source of trouble, and should be avoided. This is especially to be avoided with brass fittings, as they are easily forced open. Also be rather sparing in the use of red or white lead in making the joints, as this more often gets inside the fittings than around the threads, and hardens into a solid mass, greatly restricting the opening in many cases. Small size pipes are more susceptible to these abuses than larger ones, and should be watched accordingly. The steam pipe should be provided with a good valve, and one that can be opened rather slowly, as this will sometimes make it easier to start the injector if you happen to have wet steam to deal with.

Connect all valves so the pressure comes under the seat and tends to force them open at all times. This not only enables you to pack the stem at any time by closing the valve, but is much better in starting an injector, as the valve opens slowly as soon as you start to turn the stem, instead of hugging the seat till the slack between them and disk is taken up, and then flying open by this amount as soon as steam gets under the disk. This will be found especially true with small injectors, which are necessarily more sensitive than large ones.

It is also advisable to put all valves on in this same manner, as there have been many cases where the disk has come off the stem and was held fast to the seat by the pressure, although the valve was apparently open. In these cases the injector is blamed because it does not bore a hole through the valve disk and fill the boiler as usual.

The water supply pipe needs special attention. It must be as near air tight as can be, should be of ample size and have a strainer over the end of it to exclude particles of coal, waste, wood or other foreign matter, which might stop up the tubes or otherwise interfere with the satisfactory operation of the injector. The strainer should have enough holes, of smaller diameter than the smallest hole through the injector tubes, to make about double the area of the supply pipe. This will allow for friction of water through the holes, which is considerable, as well as the stoppage of a portion of them by foreign matter, without interfering with the working of the injector.

For lifting injectors it is customary to have the strainer in the form of a ball,



STRAINER FOR INJECTOR.

much larger than the suction pipe, and placed at the bottom of the same suction pipe. For tanks, usually placed above the injector so the water flows to it, the form shown in the accompanying sketch is simple and effective. It is formed up in the shape of a hemisphere, a section being shown, and is fastened over outlet pipe in bottom of tank. This strainer is, of course, for stationary service, although similar devices have been applied to locomotive tenders. The usual cone strainer used in tender hose, which greatly resembles a dunce cap, is responsible for much trouble in locomotive practice, as the cones fill up with small matter, and often practically close the passage. Several devices have been used and patented which obviate this and are to be recommended. They should not only provide sufficient area, but should be so arranged as to be easily cleaned without too much trouble.

When possible, place the injector in the position which the lettering on body indicates to be the correct one. No maker puts the lettering so that a man must stand on his head to read it if it is put up right. The steam connection should be either at end or top of most injectors, there being very few which can be successfully worked upside down, owing to overflow valves, which usually depend on gravity for closing.

If any pipe connection is smaller than the other two, it is the steam end. If you can see into the ends of the injector, the end having the tube with the largest hole is the steam end. Where two of the connections are opposite each other, one top and one bottom, the top one is steam, bottom one water, as the steam and water connections are always fairly close together. When connecting up the couplings furnished with the injector, be careful not to bruise them. Most of them are made with ground joints between swivel and injector, and this should not be bruised or sprung out of shape. Most makers cast lugs inside the swivels and use a flat piece of steel the inside diameter of swivel to turn it with. This saves bruising the swivels with pipe tongs and makes a much more satisfactory way of doing it.

Avoid putting up the pipes so as to bring any undue strain on the injector body, but have them so braced that they will stay in position without depending on the injector itself. These are usually of brass and not calculated for any such strain.

After all pipes are in place to suit the type of injector being used, it is well to blow or otherwise clean them out thoroughly, to get everything in shape for a good start, so that there can be no fault found with the piping when the injector sharp comes around.

LIFTING JET.

The action of lifting injectors seems to be considered more mysterious than the non-lifting, but the only real difference is in the introduction, in some form or other, of a lifting jet or auxiliary steam tube.

In the old Giffard injector it was in the form of an annular jet around a solid spindle inside the main steam tube, and projecting beyond it, and lifts the water into the combining tube, where it was ready to condense the steam used in forcing the water through the injector to the boiler.

The next form of the lifting jet was made by using a small hole in the center of the spindle. This form of lifting jet has been largely used by various makers and is known as the "central jet," to distinguish from the other pipes.

What the lifting jet really does is to exhaust air from the suction pipe, when, according to the natural law of atmospheric pressure, the water rises in the pipe, because the pressure therein is less than the pressure of the air on the surface of the water.

Theoretically, the air will sustain a column of water 34 feet high at sea level, but in practice it is difficult to get over 25 feet lift, and while this can sometimes be attained with a lifting injector, it is very sensitive, will stand very little adjustment and is more seriously affected by wear than when used on lower lifts. There is no mystery about it. Any steam jet (or any other kind of a jet, for that matter) passing an open space between two tubes, will draw the air into the jet, and with it to the opening and out of it. The air being exhausted, the water follows it, and the injector is primed ready to be started, the same as a non-lifter.

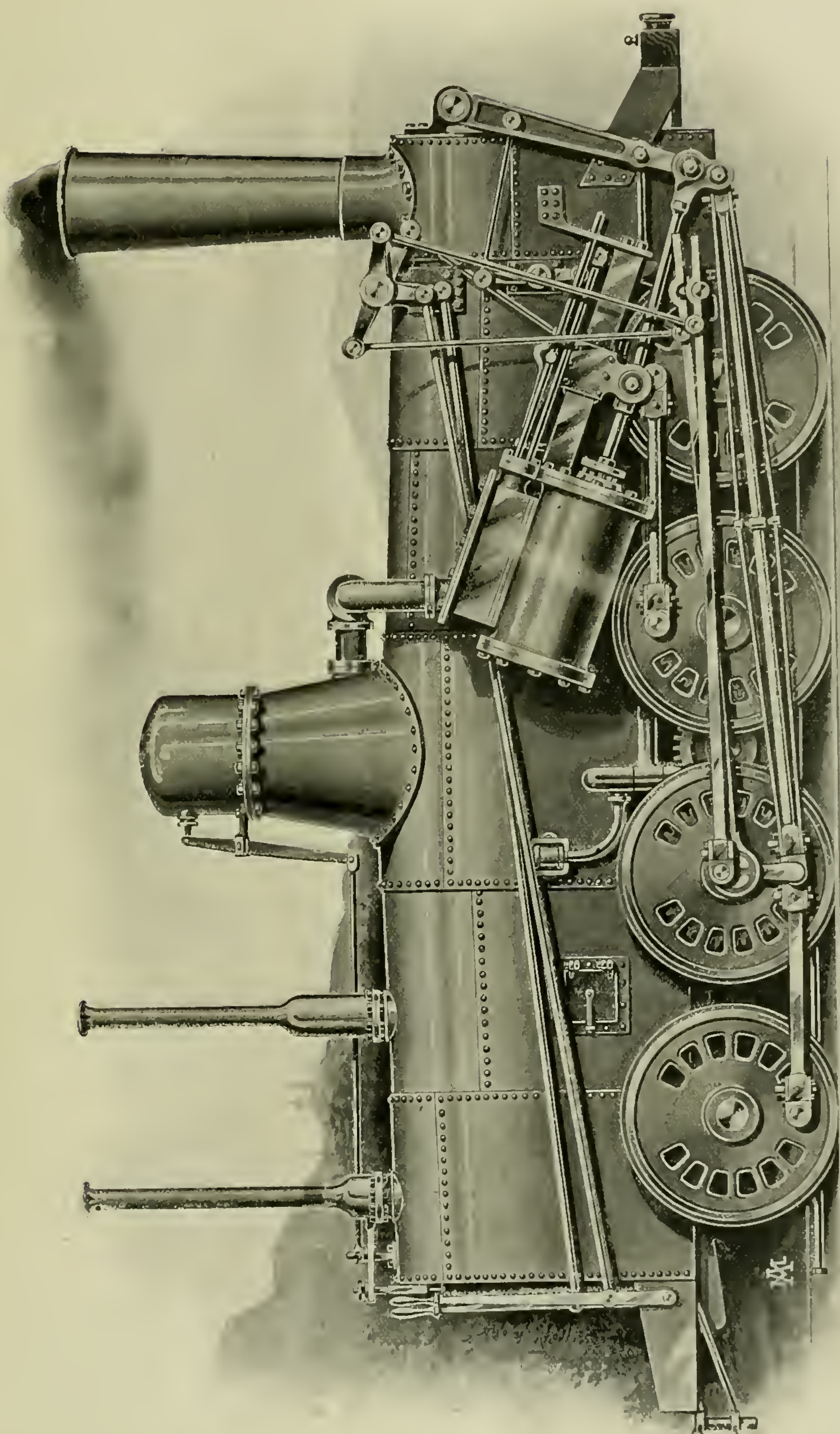
By proportioning these tubes correctly, a maximum "suction" (to use the common phrase) can be obtained with a minimum amount of steam. The jet must, however, lift enough water to condense the steam from the steam tube, to enable it to start, after which the main steam jet will take care of it, the column of water being maintained without the jet. Most injectors close the lifting jet automatically when the valve of the main steam jet is opened. Some, however, do not, but the jet does no harm except waste the steam.

The lifting jets are now usually placed in the body of the injector for convenience, but this is not necessary. In some cases they have been placed in the overflow, in the pipe beyond the injector or in the suction pipe just below the injector. When the lifter is in the injector or suction pipe, it has to force the water into the combining tube for priming, while with the lifting jet in the overflow or discharge pipe it is drawn into the injector tubes instead of being forced. There is, however, little, if any difference in the working qualities of the different jets. When the lifting jet is between the water supply and the combining tube, it must have sufficient capacity through it for enough water to supply the injector proper, and much ingenuity has been displayed in accomplishing this. The double tube injectors are on this principle and are sometimes used as non-lifters as well.

A Valuable Collection of Rails.

A complete record of the kind of rails used on the Pennsylvania's permanent way, from the earliest time, is shown in full-sized sections of each type of rail, about ⅜ inch thick, mounted on a panel, and arranged, by years, in the order of their service on the road. These rail sections are an object-lesson in track evolution, taking the observer from the old flat rail, about 2 inches wide and ¼ inch thick, as used on the Camden & Amboy Railroad in 1831, up to the T-rail of all sorts and dimensions; from thence to the inverted-U section, and then to the double-head rail, showing that foreign practice had not been neglected. From this rail the sections are of the single-head type, which has become the standard of this country by the law of the survival of the fittest, the highest development of which is seen in the 100-pound rail section also in this exhibit, bringing it down to date. The collection is one of the greatest interest to students of railroad history, and particularly valuable as the years slip by.

The people of Cheyenne, Wyo., are very much excited over the rumor that the new owners of the Union Pacific will close up the repair shops at Cheyenne.



FADS AND FANCIES IN LOCOMOTIVE BUILDING—No. 2.

CAMDEN & AMBOY EARLY FREIGHT ENGINE, THE "MONSTER," 1834.

Fads and Fancies in Locomotive Building—No. 2.

This is one of the most peculiar engines we know of, but the time at which it was built is a good excuse for many of its oddities. It was built by the Camden & Amboy Company, in 1834, and was the first engine built by them to burn anthracite coal. Her cylinders were 18 x 30 inches, and the eight driving wheels were 4 feet in diameter and all connected.

There were only four of these built and they soon came into the hands of the late Mr. Isaac Dripps to be rebuilt, some very important changes being made in both the wheel base and boiler. The modernized "monster" was illustrated in these columns in February, 1890, but this is, we believe, the only picture of the original in existence.

It will be noticed that the connection between the crossheads and the swinging link arm, is not at the same point as the connection to driving wheels, making the stroke of cylinder less than the throw of crank pin in the wheels. This led to a little confusion among some of the men, and it used to be a standing joke on new men to get them mixed up on this point.

All the wheels were drivers, but only the two pairs in the rears were driven by the main rod, which coupled on to the third pair and drove that and the rear pair direct. On the two middle axles were heavy spur gears, and between them an intermediate gear, the two forward pair of wheels being driven by these gears and the side rods shown.

These engines were not looked upon with favor by the men, and after a short time got to be considered as a punishment. In fact, instead of laying a man off for some warping of discipline, he was put to run one of the old "monsters." It is told by the railroad men who were "boys" with Mr. J. N. Sanford, now master mechanic at the Meadows for the Pennsylvania, that he always managed to evade much of this kind of punishment, for by some mysterious accident the "monster" hardly ever got over the road whole when he ran it. Something was sure to happen, and so Mr. Sanford got another engine to run. This happened so often that it got to be a standing joke with the boys, whether the officials ever caught on or not.

Fitting Up Driving Shoes and Wedges.

BY IRA A. MOORE.

The driving shoes and wedges are a very important part of the locomotive's mechanism, and it is important that they be properly fitted up. If they are not as they should be, trouble will be very apt to follow. The faces of the shoes should be

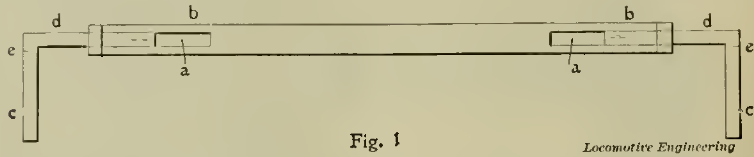


Fig. 1

exactly parallel with the axle and at right angles to the top of frame. If the faces are not parallel with the axle, the journal will be liable to heat, since the pressure upon it due to the traction of the engine will not be equally distributed. The main shoes should be of the proper thickness to bring the center of axle in the center of the pedestal, or at least in the center of pedestal on one side of the engine, and on the other side the right thickness to hold the axle at right angles to the center of cylinders.

The other shoes should be the proper thickness to give the right distance between the centers of the driving axles. The wedges should be parallel with the shoes.

How to bring these results about will be made as plain as possible in what follows. We will assume that we are working on a four-wheel connected engine, and that the frames are in line and ready otherwise for laying out, which must be done before the shoes and wedges can be fitted up. Therefore we will proceed to get some points on the frames from which to work in fitting up the shoes and wedges.

It has been said that the driving axles must be at right angles to the center of the cylinders. Hence a point must be obtained on each of the back frames and as near the center of the main pedestal as possible, through which if a line be drawn, it will be at right angles to the center of cylinders. To get these points, proceed in the following manner:

First, stretch lines through the center of cylinders and extend them 2 or 3 feet back of the back cylinder heads. Put a double square, similar to the one shown, Fig. 1, across the frames about 6 inches back of cylinder heads, and clamp it in that position. The distance is immaterial, but must be the same on both sides of the engine. The main part of this square is made of steel. The squares *d d* slide in the slots *a a*, and are held in the desired position by thumb nuts at *b b*. When the square has been secured in place, slide the squares *d d* out until they just touch the lines through the cylinders, as shown at *c*, Fig. 1. Make a mark on the

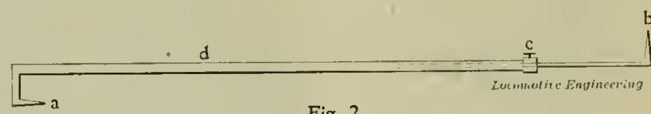


Fig. 2

edge of the squares, as shown at *c*, the same distance above the line on each side of engine. With a tram like the one shown in Fig. 2 get a point on the cylinder saddle casting midway between the centers of cylinders, and as low as possible. The main part *d* of this tram is made of ¼-inch pipe (except the point *a*, which is of steel), into which a piece of round steel with a point bent at right angles to its length is made to slide, and is held in any desired place by the thumbscrew *c*.

To use this tram, place the point *a* against the vertical part of the double square, keeping the body of tram in front of the square, and the point *a* on the mark *c*, Fig. 1, mentioned above. Then with point *b*, Fig. 2, scribe an arc on the saddle casting as near as possible to the center. Do the same on the other side of engine, and if the tram is the right length, the arcs will intersect near the bottom of saddle casting. Mark the center with a center-punch, as we will have occasion

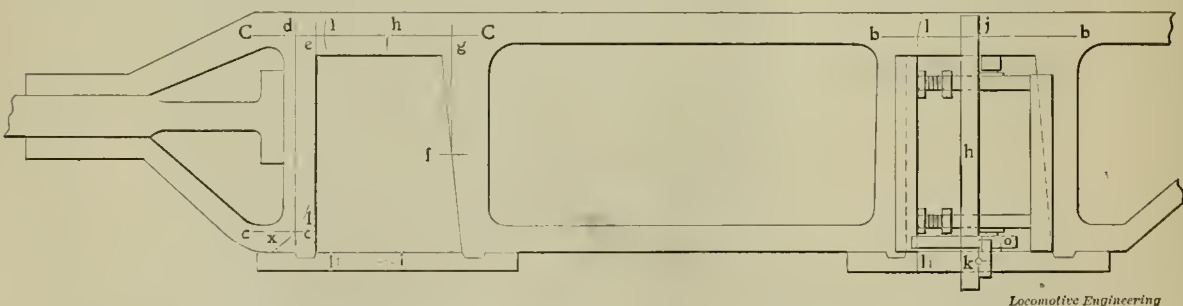


Fig. 3

to use this point later on. Call this point *a*. On the outside, and parallel with the top of the frame, draw the lines *b b*, *C C*, Fig. 3, directly above and extending a short distance back and front of pedestals, making them all the same distance below the top of frame.

Now on the front jaw of each of the

Fig. 4

front pedestals draw the line *c c* parallel with the line *b b* and the same distance below it on each frame. The body of the tram, shown in Fig. 4, is made of ½-inch pipe, with the points of steel, one end being made to slide into the pipe in order to admit of adjustment, and is held in place by the set-screw *t*.

With the straight point of this tram in the point *a* on cylinder saddle casting, scribe the arc *l*, Fig. 3, on the front pedestal jaw and across the line *c c*. Mark the

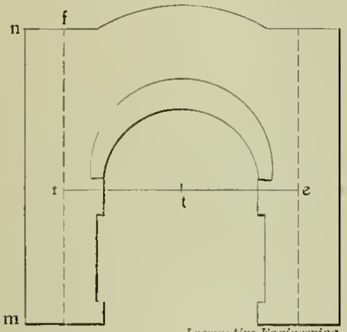


Fig. 5

point of intersection of line and arc with a small center punch, then try the tram in it to prove its correctness. Repeat the operation on opposite side of the engine. Call these points *x*.

A little consideration will now show that if a line be drawn through the points *x x* it will be at right angles to the center of cylinders. Now take a T square and draw a line through *x* and at right angles to the top of frame. Make a center punch mark where this line crosses the line *C C* and call this point *d*. Do the same on the other frame. A line drawn through *d d* will be parallel to the line through *x x*,

Fig. 6

hence will be at right angles to center of cylinders.

Now we must find the point *h*, through which, if a line be drawn at right angles to the top of frame, it will pass through the center of pedestal. A very good way to find this point is to draw a line from the upper end of the face of front pedestal jaw across and at right angles to *b b*. Make a center punch mark where the lines cross and call this point *e*. Draw a similar line from *f*, which is midway between the top and bottom ends of the back pedestal jaw. Call its point of intersection with *C C* point *g*. The point *h* is midway between *e* and *g*. Set a pair of large dividers to the points *d* and *h*. Then with *d* on opposite frame, as a center, scribe an arc across the line *C C*, and the point of intersection is the point *h* on that frame.

Now take the T square and draw a line through *h* and across the pedestal binder on both sides of engine. Make a center punch mark *i* on this line and near the center of the edge of pedestal binder on one side, set a small tram to *h* and *i*, then with *h* on opposite frame as a center scribe an arc across the line previously drawn across the edge of pedestal binder. The point of intersection is the point *i* on that side of engine.

The distance from *h* to *j* on the back pedestals is 1-32 inch less than the length of the side rod, which length is the distance from center to center of rod brasses.

The 1-32 inch difference is due to the difference in temperatures of the frame and rod when the engine is in working order.

Therefore, to find the point *j*, Fig. 3, put centers in the rod brasses, then set a long tram to 1-32 inch less than the distance between these centers. Now with *h* as a center scribe an arc across the line *b b*. The point of intersection is the point *j*. Without altering the length of tram, and with *i* as a center, scribe an arc across the edge of back pedestal binder. Now take the small tram, set it to *h i* and with *j* as a center scribe an arc on the back pedestal binder and across the one drawn with the

Fig. 7

long tram. The point of intersection is the point *k*. Get the corresponding points on the other side in the same manner.

Now get the size of the driving box with calipers and scale, set a pair of dividers to half the size, and with *j* and *k* as centers scribe the arc *l* on frame and l_1 on pedestal binder. It is easy to see that the face of the shoe when it is finished must be in a straight line between these arcs in order to have the center of axle *t* (Fig. 5) in a line between *j* and *k*. If the boxes are not all the same size, the same operation must be gone through for all boxes of a different size. If, as is sometimes the case, the brass is bored out of center, or, in other words, the distance *r t* is not the same as *e t*, Fig. 5, a different course must be pursued.

Put a center in the brass, being careful to have it flush with the side of the box, and with a pair of hermaphrodite calipers find the center *t*. Scribe a line on the box at right angles to *m n* and through *t*, also a line at *r* at right angles to the line through the center and exactly opposite the face, or part of the box that comes in contact with the shoe. Now, if *r* is the front of the box set the dividers to *r t* and scribes the arcs $l\ l_1$ as described above.

We are now ready for the shoes and wedges. The length of the shoes should be 1-32 inch less than the distance from the top of pedestal to the pedestal binder, and they should be faced to the pedestal jaw. The wedges should be 2 inches shorter than the shoes, and faced to pedestal jaw same as shoes.

Assuming that they have all been treated in the manner described, we will proceed to lay them out for planing. Put each one in its proper place, and put about 5-16 inch under each wedge, then they will be that distance away from the pedestal binder when they are adjusted to the size of the box. This is to allow them to be pulled down to give the box room to expand if it should heat. Some plan must be used to hold them firmly against the pedestal jaws while being laid out, and a very good one is to use what is termed spreaders, one of which is shown in Fig. 6. It is made of a short piece of 1-inch pipe, which is slipped over the end of a ⅞-inch hexagon headed bolt onto which a nut has been screwed.

Use two of these in each pedestal, as shown in Fig. 3. Put one about 2 inches from the top of pedestal and the other the same distance from the bottom. Now, secure a straight-edge about 5 feet long between the pedestal binders and the bottom spreader, by means of block of wood and a small wooden wedge, as shown at *o*, Fig. 3.

In the same way secure another straight-edge between the top spreader and top of pedestal also shown in Fig. 3. Now, with a small straight-edge *h*, Fig. 3, adjust the others so that their front edges will lie in a line between *j* and *k*, or *h* and *i*, as the case may be. Of course, this must be done at each end of the long straight-edges in order to have them parallel with the center of axle.

It is plain that the straight-edges now occupy the same horizontal position that we desire the center of axle to occupy when we have finished. Now, set an adjustable square to half the size of the driving-box +½ inch, or, if the brass is not bored out central, set the square to the distance *r t* (Fig. 5) +½ inch. Put the square against the back edge of the short straight-edge, letting the blade extend forward along the side of the flange of the shoe, being careful to keep the blade parallel with the frame, as shown in Fig. 3. Then with a scratch-awl against the end of the blade of the square, scribe a line on the side or flange of the shoe. Make two lines on the outside flange and as near the end of shoe as possible, and one on the inside about midway of the shoe's length. Do the same to the shoe on the other side, then change the straight-edges to the front pedestal and repeat the operation, when the shoes will be ready for the planer.

After being planed the face should be exactly ½ inch from the lines on the flanges. The reason ½ inch is added to half the size of the box when laying the shoes out is that there may be some way to prove that they have been planed as laid out, then it is easier to plane to a certain distance of a line than exactly to it.

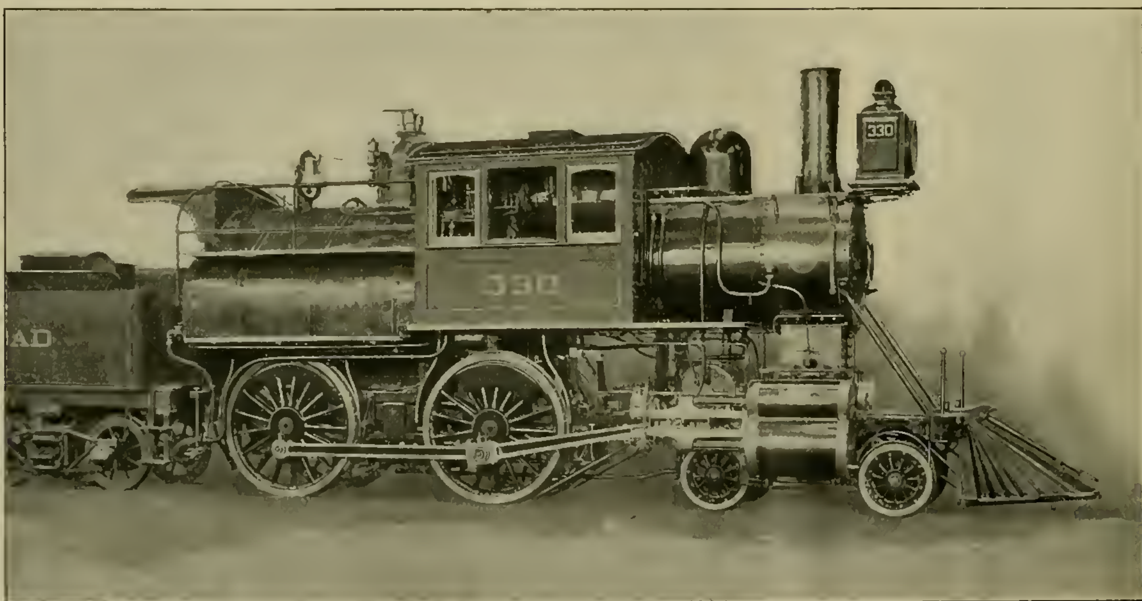
When the shoes have been planed, put them in place again and put in the spreaders. Now, lay out the wedges from the shoes in the following manner: Set the adjustable square to the size of the box + ½ inch, then with the head of the square against the face of the shoe scribe lines on the flanges of wedges similar to those on the shoes and in the same relative position. Set them upon the planer bed by these lines and plane in the same manner as the shoes.

Since it is with the flanges of the shoes and wedges that the lateral motion of the engine is regulated, the outside flanges must have a certain thickness which may be found as follows:

On a smooth strip of wood mark off the distance *a b*, Fig. 7, which is the distance between the wheel hubs, also the distance *a c*, from outside to outside of frames. Draw the line *d* across the stick, making the distance between it and *b* equal to the lateral motion desired, which should be 3-32 inch for the front and ⅛ inch for the back wheels. Now, make the distance from *d* to *e* equal to twice the thickness of the outside flange of the driving box. Then half the distance *e c* will be the thickness of the outside flanges of the shoes and wedges.

Enough should be planed off the inside flanges to make the width of the shoes and wedges 3-32 inch less than distance between the flanges of the driving boxes and the corners should be rounded enough to clear the fillets in the boxes and no more, since that would weaken the flanges and increase their liability to crack.

Cedar Rapids, Ia.



ERIE REBUILT LOCOMOTIVE.

Rebuilt Erie Locomotives.

The locomotive shown in the annexed engraving is one of 48 recently changed by the Baldwin Locomotive Works from simple to compound, for the Erie Railroad. These engines are reported to be doing excellent work in service, much superior to that performed when they were simple.

They are all equipped with Westinghouse American outside equalized air brakes on all driving wheels, with 9½-inch pump, and train signal. Working pressure, 180 pounds. Boiler, Wootten pattern; material, steel ⅝ inch thick. Longitudinal seams, butt jointed with double covering strips. Magnesia sectional lagging. Piston balance valves. Nathan sight feed lubricator. United States metallic packing on all piston rods and steam valves. Leaches sanding device. Two Metropolitan injectors.

The following are a few of the leading dimensions.

Cylinders, high pressure — 12½ x 22 inches.
Cylinders, low pressure—21 x 22 inches.
Drivers—68 inches.
Total wheel base—23 feet 4 inches.
Driving wheel base—8 feet 6 inches.
Weight, total—110,000 pounds.
Weight on drivers—71,330 pounds.
Boiler, diameter—56 inches.
Number of tubes—324.
Diameter of tubes—1½ inches.
Length of tubes, 10 feet 2⅛ inches.
Firebox, length—101⅞ inches.
Firebox, width—96 inches.
Truck wheels, diameter—30 inches.
Truck journals—6 x 10 inches.
Driving axle journals—7½ x 10 inches.

The Klondike fever has induced the Baltimore & Ohio and other trunk lines to pay attention to through travel in that direction, as it is estimated that 100,000 persons will start for the gold regions in the spring. Through tourist cars are to be run from New York to San Francisco without change. This will be quite an accommodation to many, and enable them to carry a trunk full of canned baked beans, brown bread or Frankfurters, if they want to go cheaply.

The Falls Hollow Staybolt Company have sent us a small sample of their material which is sheared on one end and broken on the other. The broken end shows by the fracture a fine material for staybolts.

Practical Letters from Practical Men.

All letters in this Department must have name of author attached.

Effect of Changing Main Drivers End for End.

Editors:

I would regard it as a favor to have an answer to the following question as put to me by an old-time engineer, namely: Would an engine move if I took the main pair of drivers out and turned them end for end, and did not move the eccentrics, but coupled up the eccentric straps to their respective eccentrics? I claimed that she would not move, and the engineer said she would go about ten feet ahead and then ten feet back without any change of the reverse lever.

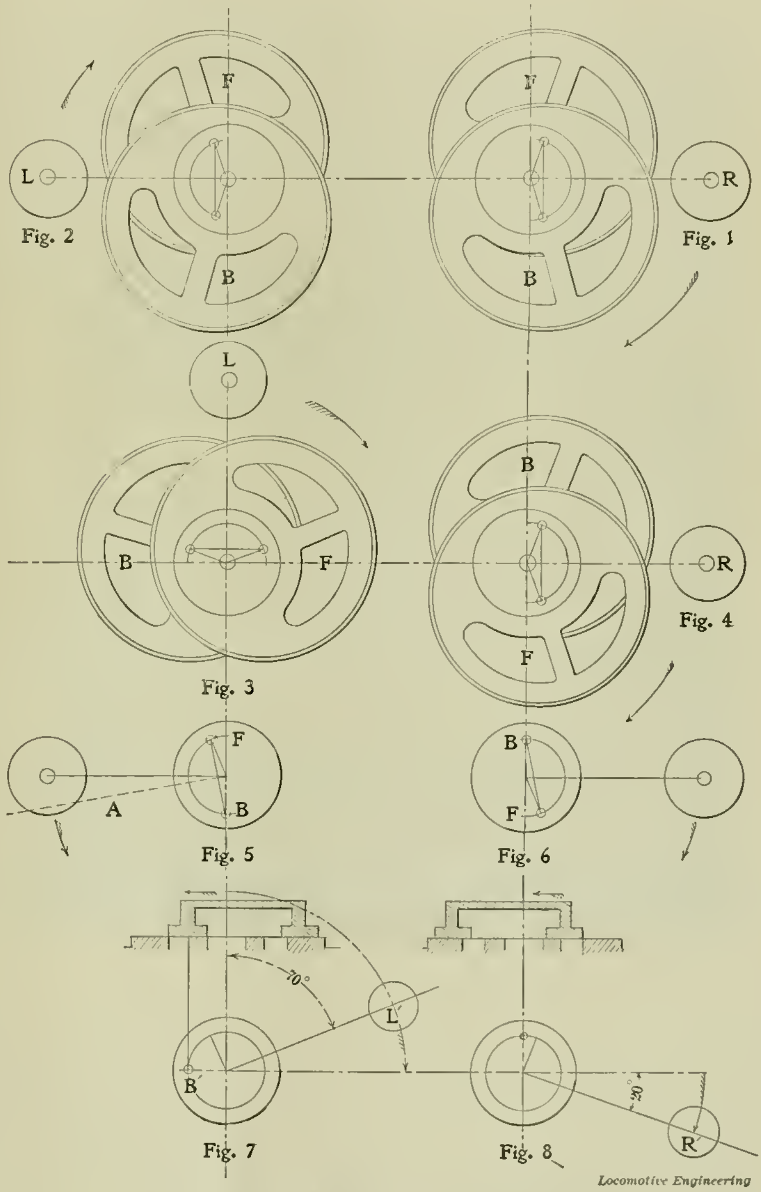
CHAS. A. VIEG.

Beatrice, Neb.

[An answer to this question would have to be accepted on faith without the aid of descriptive cuts to simplify it. The engravings will show the resulting effect of a change as proposed, if they are made to represent the main axle and pin with the eccentrics in position. Figs. 1 to 4. inclusive, show the eccentrics with their centers perpendicular to a center line of motion which is assumed to be coincident with the center line of cylinder; the eccentrics having an angular advance sufficient to open the steam port when the pin is on its center.

The views are all supposed to be seen from the right-hand side of the engine. Fig. 1 is the right-hand axle with the main pin on the forward center and ready to move ahead, or in the direction indicated by the arrow; the setting of the eccentrics will be seen to be correct for this movement. If this Fig. 1 is now turned end for end and brought to the left-hand side, it will be in the position seen in Fig. 2 when viewed from the right-hand side, with the pin on the back center. While this turning of the axle has taken place, the left-hand pin has been transferred to the right-hand side, and since it was on its upper quarter prior to being moved, it follows that it would still be in the same position, as seen in Fig. 3. In order to get this pin in the same position occupied by the right-hand pin before turning took place, it must be advanced one-quarter of a turn, as shown in Fig. 4, and what was the original right-hand pin in Fig. 2 is now the left-hand pin shown in Fig. 3, since each pin must move through an angle of 90 degrees in changing position by rotation.

What effect this transfer of wheels has on the eccentrics may now be noted. In Fig. 1 the go-ahead eccentric is indicated by the letter *F* and the back-up eccentric by the letter *B*, and it is seen by a reference to Fig. 2 that in the transfer from right to left, the eccentric marked *F* is now ahead of the pin instead of back of it, as in Fig. 1, and is so found in Figs. 3 and 4, but this reversal of eccentrics will not introduce any distortion in the valve movement when the go-ahead rod is coupled up to eccentric *B*, and the back-up to eccentric *F*, for the reason that the eccentric centers stand in the same relation to the pins as they did before the axle was turned. This is seen by comparing Figs. 1 and 4; the engine, therefore, will run just the same as before the axle was turned end for end.



EFFECT OF CHANGING DRIVERS END FOR END.

What the effect will be when the center line of motion is not coincident with the center of the cylinder will next be considered. In Fig. 5 the center line of motion is shown more nearly in accord with conditions obtaining in locomotive practice, but exaggerated, to make it plain. Line *A* shows at an angle with the center line of crank, which is assumed to be left side on forward center, and since the eccentric centers must be perpendicular to line *A*, it follows that the eccentrics will have a new location as shown by their centers which are designated by the same letters as in the other figures.

On turning Fig. 5 from the left-hand side to the right, it will be in the position shown in Fig. 6 with its direction of motion changed, and eccentric centers transposed as in the former cases. The eccentric *B* is now the go-ahead, and since the position of its center is seen to be moved back an amount equal to the angular advance of its mate, it is plain that the lower end of rocker has been moved toward the eccentric, while the upper end of rocker and with it the valve have been advanced over the valve seat so as to cover the port an amount equal to the lap and lead, assuming that the rocker arms are equal in length. The engine cannot, therefore, take steam on the right-hand side until after the piston has started on its return stroke.

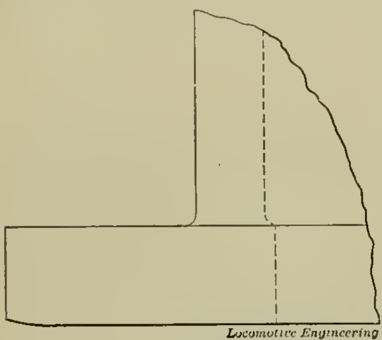


Fig. 4

An examination, however, of what is going on at the left-hand side may be made by a reference to Fig. 7, in which the location of the go-ahead eccentric for the new conditions is shown with its center at *B'*. This position causes the valve to be at the extreme forward end of its travel, and the back port is therefore wide open to admission while the pin is in its most advantageous position for work, that is, on its upper quarter, and the engine will therefore move ahead, because the pin passes through an angle of about 70 degrees before cut-off occurs, and the port, it will be seen, must remain open until the valve on the right-hand side has opened the front port to admission, as shown in Fig. 8, where the pin has traveled through an arc of about 20 degrees on its return stroke before the valve began to open the front port for admission. It will thus be seen that the engine will move in one direction continuously even when the valve motion is badly distorted, although such an arrangement would not be conducive to economy. These engravings cover average eccentric conditions, and are furnished at some length for the purpose of making it plain that such questions as these may be answered by a little mental effort, by which all ordinary valve motion problems narrow down to an easy solution. To assist to a clearer understanding of the subject than is conveyed by the engravings, it is recommended that traced copies of them be made on thin paper; the reproductions may then be turned to any position and thus prove the propositions made.—Ed.]

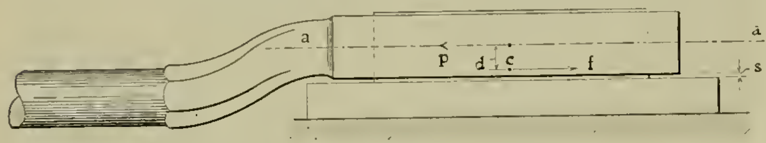


Fig. 1

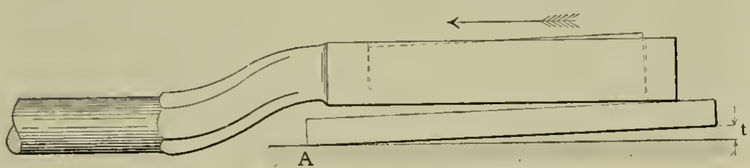


Fig. 2

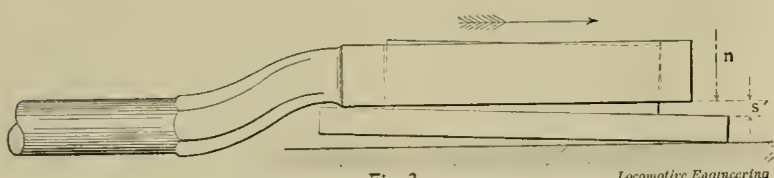


Fig. 3

WEAR OF THE SLIDE VALVES.

Wear of Slide Valves.

Editors:

As no one has offered any comment on your correspondent's letter concerning the above subject (see November issue), I thought I would say something about it. There's an explanation of the matter somewhere or other, of course, as in fact there is of everything else, however strange or unusual.

In what follows, I have assumed that the engines in question are of English make, with unbalanced valves working upright between the cylinders, the valve stems having a "set" as shown in Fig. 1, which represents the parts when new. (All the sketches are plan views.)

It will be seen that the center of gravity of the valve *c* does not lie on the center line *a a* of the valve stem, so that the two forces *p*, the pull of the stem, and *f*, the resistance due to the valve's inertia, form a couple whose arm is *d*. The tendency of this couple is to rotate the valve on a vertical axis till *c* lies on the line of pull. This throws the wear onto the end *A*, Fig. 2. Something similar takes place on the return stroke, Fig. 3.

Now, the tendency to tilt increases with the valve wear, because as this wear takes place, the valve recedes further through the yoke and the net effect of the overhang becomes greater, this effect increasing, the heavier the valve flange is, compared with the body. At the same time, the range through which tilting can take place is also increased, owing to the increase of *s*, the clearance between the valve and the yoke. With a 6½-inch body and a yoke 1½ inches deep, and 3-32-inch play between the two, the end of the valve could tilt about three-quarters of an inch (by calculation). In actual working, however, the tilt of the valve, *t*, is limited by the amount of space between yoke and valve, *s'*, Fig. 3. This may be anything up to ½ inch, or more, depending on the valve wear allowed, and the initial clearance *s*.

Now this tilting action can occur much more readily in the case under consideration than if the valves were horizontal as in American practice, for in the latter case the twisting couple exists just the same, but its action is opposed by the valve's weight. This is not so in the present case, however, the valve, in fact, having to be merely slewed round, no portion of it having to be lifted at all.

It seems probable that this tilting only takes place when drifting, as the steam keeps the valve on its seat at other times, the pressure being so great—compared with the dead weight of the valve—that the above eccentricity of forces does not take effect. If this is not so, how about the steam distribution? In any case, it would be interesting to see cards taken from the engine in question (the one that owns the valves given in November number).

In English engines, as a rule, the valve falls away from the face when steam is off. If you are near the front end of an engine when starting, you can hear a sharp click directly the throttle is opened. I've always attributed this to the valve striking up against the port face. It used to be the practice to put a helical spring into each corner of the yoke; these were about ¾ inch diameter, 13 or 14 B. W. G. and let into the yoke about 1 inch. These springs keep the valve up to the seat when steam was shut off. I don't think there was much in it, however.

Regarding the eccentricity of pull, it might seem to some, at first sight, that the set in the stem would ameliorate matters somewhat. I don't think it will, though, even if the center line of stem were to pass through the c. g. of the valve, as is about the case in the annexed sketches. The reason is that the yoke is a loose fit. If the whole affair—stem, yoke and valve—were solid and there were no spring in the stem, the tilting action would disappear. These stems are set thus to get room for the stuffing-boxes.

I remember that when this question first appeared, mention was made of the lifting action of the rocker pin, where the connections were rigid throughout, i. e., no knuckle-joint or other device being employed. I doubt if there is much in this objection, however, for the stuffing-box and gland are sure to arrest a lot of the vertical motion and so prevent its passing to the valve, and the play in the yoke (even when newly fitted) will look after the remainder. In fact, figuring it out with same yoke dimensions as before, and the short distance of 60 inches from front end of yoke to rocker pin, I find that with 1-50 inch play in the yoke, the rocker-pin end of rod can lift 13-16 inch before the yoke will bind on the valve at all. Now, with a 5½-inch travel and 11½-inch rocker arm, the pin describes an arc whose rise is .7 inch. Assuming the center line of valve rod to bisect this rise, we have a vertical movement of only .35 inch to consider. Now, this amount wouldn't affect the valve at all, even if (for sake of argument) there were no stuffing-box present. In fact, I have never considered this vibration of the valve rod in the light of affecting the valve injuriously, but have regarded it as a matter to be settled between the rod itself and the packing. Either the rod must spring or the packing must yield; it's the packing I've always felt for. Again, the above figures are for full travel, and an engine don't pass much of her time down in the corner, unless a switcher. As she is hooked up, this vertical motion rapidly disappears; with a 3-inch travel the total vertical motion is only just over 3-16 inch.

Leaving out of the question, however, any possible ill effect on the rod or packing, it must be admitted that the solid connection presents one of the most unmechanical features ever met with in locomotive practice. On the other hand, when you see a valve-rod with a knuckle-joint or a slotted end, you experience quite a soothing feeling; even here, though, there's a fly in the ointment, in the shape of the multiplication of wearing surfaces just where they're not wanted.

It is very probable that a combination of the reasons put forward by Mr. Riekie and myself, viz., unequal pressure and unsymmetrical construction, is responsible for the wear. Mr. R. remarks that when the back port, say, is uncovered, there is an excess of pressure on the far flange, at arrow *n*, Fig. 3. Now, this contingency and the action I have alluded to act concurrently, as shown in Fig. 3, and doubtless their joint effect produces the wear in question.

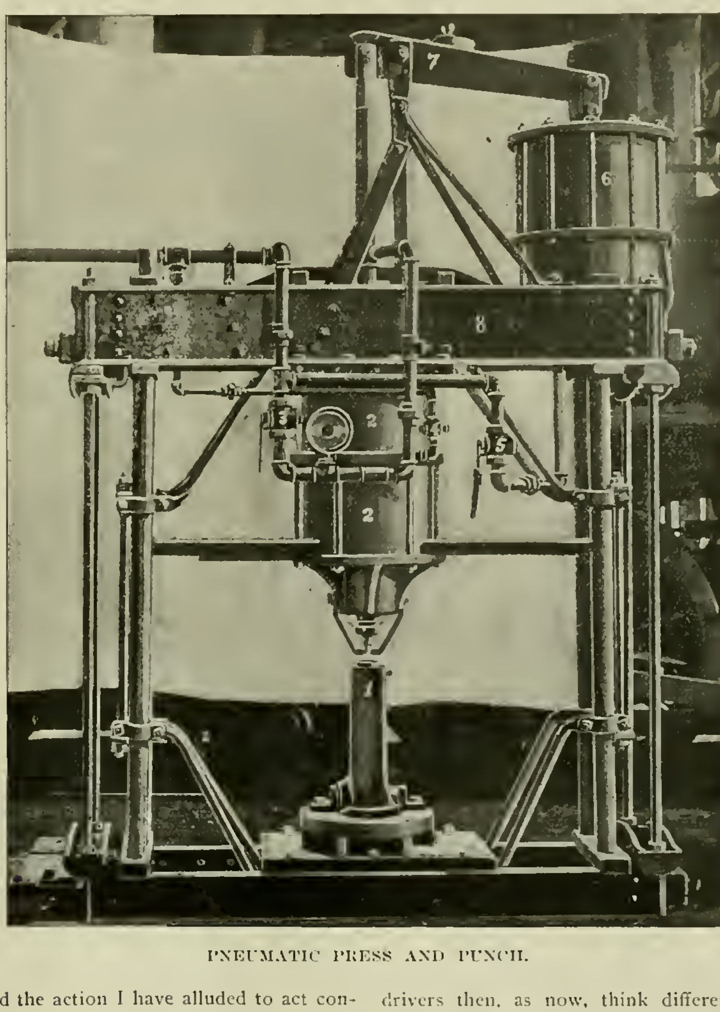
In a good many English engines the valve stems are continued on the front side of the yoke, working in dummy glands in the steam chest cover. The presence of such a valve stem would not affect the above arguments, however, for it has been assumed that the yoke moves in a straight line.

Thinking over the effect of Mr. Riekie's valve wear on the steam distribution, reminds me of what used to be done, "under the rose," in a railroad repair shop in London where I was some years ago. Certain of the drivers used to "tip" some of the younger bench hands to take the edge off their valves, as occasion offered. The lads never thought of what it meant; it sufficed for them that they could earn half a crown by doing the job. Fig. 4 shows one of the edges thus filed away; both edges were treated thus. The idea was to make the engine smarter, by increasing the lead. I know that the efficacy of lead is being questioned nowadays, but this does not alter the fact that the majority of drivers then, as now, think differently. They are right as to the lead helping her to get away with train; but it increases so when hooked up that she seems to be working against herself.

The above anecdote illustrates what I have remarked before in print, that the S. M. P. is generally the last man to know what is going on. Designers and officials expend much grey matter in developing a certain thing, and after all it may be monkeyed with and upset by irresponsible parties in the shops and roundhouses.

H. Rolfe.

Scranton, Pa.



PNEUMATIC PRESS AND PUNCH.

Pneumatic Press and Punch.

Editors:

The pneumatic press and punch shown on page 85 was designed by Mr. M. Y. Drucy, general foreman, and is quite a novelty in its way. It was constructed of material gathered up around the shop. The top and base are made from channel bars of a tank truck with 1¼ inch rods run through bars to support centers, the bars being held together with 2-inch rods running through 2½-inch flues keyed top and bottom. The table is a center casting bolted to base. The cylinders are made of packing ring pots grooved together. They are 16 inches diameter and 8-inch stroke.

The air is operated by a stop cock which has been drilled and converted into a three-way cock to release the air after the stroke is done. The capacity of the press with 90 pounds pressure is 20 tons, a gage being used to show the total pressure. The cylinder No. 6 is same general dimensions as No. 2, but is single acting. By means of connections with lever 7, the power from 6 is transmitted to the cylinder 2. The lower piston rod of this cylinder is counter-bored for punch and a drawbar bolted to center casting serves as a die holder. When the two cylinders are acting together, the capacity of the punch is 50 tons. By removing block and taking end bolt out of 7, we have a press of 8-inch stroke.

We do all our boiler work on this punch, using 29-32-inch punch in ⅜-inch steel plate. As a press for driving box brasses or rod brasses, there is nothing better.

E. H. ADDINGTON.

Arkansas City, Kan.

Setting Eccentrics.

Editors:

Much has been written on this subject, and it may possibly seem like rethreshing old straw to give the following description of the method followed in the Fall Brook shops, but as the process is simple and accurate it may be of interest to some.

The graphic method followed by many which appears so simple on paper, is often so cumbersome in practice as to almost preclude using it on actual work.

In Fig. 1 the main wheels are shown in position on a level piece of track with the crank pin in a vertical position over center of axle. This is found by the two plumb lines coinciding with the circle *B*, scribed on the end of the axle, of a diameter equal to that of the collar of the pin over which the plumb lines hang.

With the wheel securely blocked in this position the two quarter points *G* and *K* are found on the axle *D* by the center gage and level *C*, Fig. 2, and are marked on the axle by light prick marks. From these points the advance is set off with dividers, giving the points *H* and *J*, and the center line of each eccentric *C L N* and *J M* is made to correspond with its respective advance line. In the sketch the dotted circles *F* and *E* represent the eccentrics and *P* the crank pin.

The keyways are marked off and laid out as shown in Fig. 3, and then the wheels

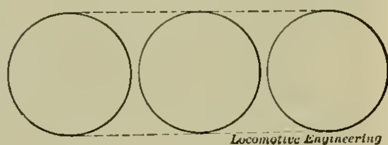


Fig. 3

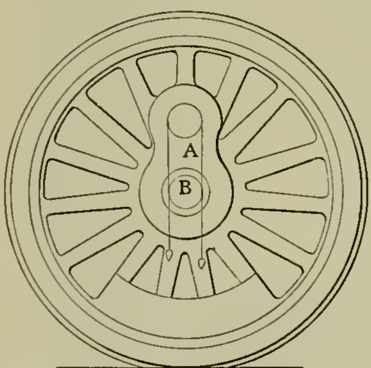


Fig. 1

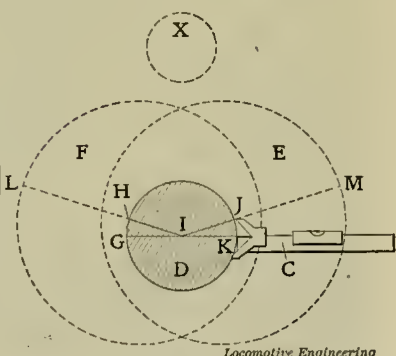


Fig. 2

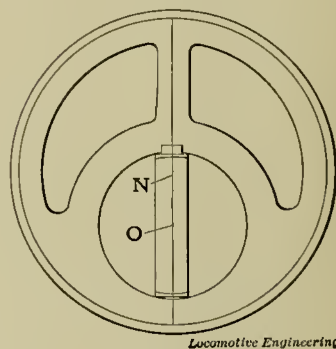


Fig. 4

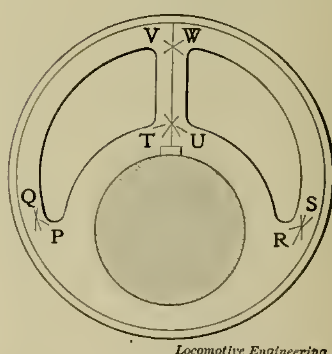


Fig. 5

SETTING ECCENTRICS.

are rolled to a radial drill and each keyway drilled out with three counterbore holes ¼ inch deep. This leaves very little stock to be cut out with the hammer and chisel, which will be appreciated by those who have had any experience on some of the steel axles now used.

The keys are made with rounded ends to fit the keyways, and are equally as good as if made with square ends.

The amount of advance can be found by the graphical method, or preferably by the formula:

$$O = \frac{A\ L\ D}{U\ T} - \left(\frac{2\ D}{R}\right)^2 \text{ in which}$$

O=Amount of advance.

A=Lap of valve plus the lead.

L=Length of the lower rocker arm.

D=Diameter of axle.

U=Length of the upper rocker arm.

T=Throw of eccentric.

R=Radius of link motion.

All dimensions in inches.

To illustrate, a locomotive has a valve of ¾ inch lap, 1-16 inch lead, upper rocker arm 11 inches long, lower rocker arm 10 inches long, axle 7 inches diameter, throw of eccentric 5¼ inches, and radius of link 81 inches. The equation will then be as follows:

$$O = \frac{\frac{13}{16} \times 10 \times 7}{11 \times 5\frac{1}{4}} - \left(\frac{2 \times 7}{81}\right)^2$$

$$= \frac{130}{132} - \frac{196}{6{,}561}$$

$$= \frac{61}{64}'' \text{ advance nearly.}$$

The formula, while not theoretically exact, is so near that in practice it can be accepted for all angular advances under 20 degrees.

It assumes the chord distance *G N* to be equal to the sine of the angle *N I G* which is nearly the case.

The amount $\left(\frac{2\ D}{R}\right)^2$ subtracted is a correction found necessary, and as will be seen it is greater with short than with long radii of link motion. It is probably caused by the angularity of the eccentric rods, but just how is rather obscure.

In Fig. 4 the center line of the eccentric is found by drawing a line through the center of the eccentric *N* and the center of the hole for the axle *O*. This requires the eccentrics to be removed from the axle. When this cannot be done the center line can be found as shown in Fig. 5.

The two arcs *Q* and *S* are struck concentric with the axle by means of V-block carrying a pointer. Intersecting these arcs are the two arcs *P* and *R* concentric with the outside of the eccentric. From these intersections, with dividers, the arcs *T U* and *V W* are struck. Through these the center line is drawn as shown.

For locomotives that have the center of the lower rocker pin below the piston line the amount of advance is found by the method already given, and that for the forward eccentric increased and for backward one decreased by an equal amount found by the proportion

$R : r : : k : x$ in which

R=Radius of link motion.

r=Radius of axle.

k=Distance rocker pin is below center line of cylinder.

x=Amount to be added and subtracted from advance found.

Thus, if $R = 81''$, $r = 3\frac{3}{8}''$, $k = 3''$, then $81x = 10\frac{1}{8}$ or $x = \frac{1}{8}''$.

Then, instead of having $\frac{61}{64}''$ advance, the forward eccentric will be advanced $\frac{61}{64} + \frac{1}{8} = \frac{69}{64}''$, and the backward one $\frac{61}{64} - \frac{1}{8} = \frac{53}{64}''$.

FRED E. ROGERS.

Corning, N. Y.

Youngest Subscriber.

Editors:

Noticing in your issue of December, 1897, page 890, a letter from a Washington correspondent stating that he had subscribed at fourteen years of age, and asking if you knew of anyone having subscribed at a younger age, I would like to say that I started to subscribe July, 1894, and was then only between eleven and twelve years old.

WM. M. FISCHER.

New York City.

Saving Oil and Wasting Coal.

Editors:

In the present great struggle for economy in the operating of railroads, it is claimed that next to wages the greatest expense in operating is for fuel. Doubtless the claim is just, and oil sinks into insignificance alongside of the black diamonds, and there is little doubt but that in many instances a little more of the oil judiciously used by engineers would result in a saving of dollars in coal, the extra oil used costing but cents. Until recently we have been educated to economize as far as possible in the use of oil, while the much more important factor of fuel has been apparently a secondary consideration. The present master mechanic of this division (Rocky Mountain) was the first man I had worked under who gave this important subject more than passing attention, and where we formerly struggled to be away up on the oil sheet, we are now being educated that oil is secondary to coal, which is doubtless correct. "Enough is as good as a feast," is as true in the use of oil as coal, but a little less of the former than is necessary to thoroughly lubricate every bearing has a very serious effect on the latter, if figured on a dollar and cents basis and a year's performance sheet.

While I know of many instances that could be used to illustrate the subject at issue, I need go no further than my own experience to see where much coal was formerly wasted by running an engine with barely enough oil to keep engine from getting hot, where, doubtless, had I used more valve oil I would have put dollars in the stockholders' pockets, whereas a false economy only put cents. I thought as long as a cylinder did not groan that such cylinder was getting sufficient oil, but my narrow-brained figuring got a tumble one day, on an engine I was running nearly 300 miles to the pint (besides a great deal of switching). A cylinder head got knocked out, and although cylinder was neither cut nor scratched, in half an hour the whole inside surface looked as rusty as though engine had lain in "bone yard" a month—evidence that cylinders were not getting sufficiently lubricated, thereby causing an indirect but costly effect on coal pile.

While this ground has been gone over in different routes by able writers, it still needs cultivation, and while we cannot plead guilty of being much on said cultivation, we will be repaid for our labors if this article should be the means of stirring up a controversy that will be both cultivating and educating. To obtain economical results and still pull the ever increasing trains of to-day, we must first have a boiler sufficiently large and entirely clean of scale and sediment, with a good arch in fire-box; second, a front end with a nozzle, neither too large nor small, with netting and diaphragm correct size, and in proper place; third, tight valves, cylinder packing and damper (this last receiving too little attention); fourth, an intelligent engineer and fireman, working for each other's interest, and therefore the company's. In addition to which is needed sufficient (and efficient) road foremen, to assist men who are trying to economize, by teaching best methods of true economy. Generally speaking, road foremen have districts too long to be thoroughly familiar with every engineer and fireman under them, and I believe that a road foreman should know well every man under him, and their habits on and off duty. It has been my privilege to travel around the country a good deal, and ride over many trunk roads, and always at some point en route we saw engines doing a great deal of unnecessary popping, dampers wide open (sometimes gone entirely), air pump making at least a mile per minute, and depending on governor for intermittent rests. Upon looking closely at the volume of black smoke rolling from the stack, we could see printed in inky letters, "road foreman wanted." The single subject of dampers needs a great deal more attention, and we have always noticed that the fireman who works his dampers, particularly front one, is well up on the performance sheet and is rated a "top notcher." In the wood-burner days dampers were fitted nearly air-tight to save wood—why not coal? LOCOMOTIVE ENGINEERING is the proper channel to air your views, boys, and unless you have got some antediluvian devices "to save a hundred per cent. of steam" in your mind, let us work intelligently with what we have, and we can at least be credited with doing our best.

L. D. SHAFFNER.

Missoula, Mont.

Roundhouse Chat.

EFFECT OF EXHAUST ON THE DRAFT—WHY?

Editors:

Another question came up among the boys the other day, which was rather interesting before we got through with it, and which left some of us in doubt about a question we were dead sure of before.

One of the new men asked why the exhaust from the nozzles made a draft for the fire, and everyone thought he was a greenhorn, till they all tried to tell him at once, and didn't.

"Why," said one, "it just pushes air out of the front end, and the air from the fire-box rushes to fill its place. That's dead easy."

"Well, then, how much air is forced out, and how much is it necessary to force or pull through the grates to make steam enough on one of these fast runs?"

Nobody knew how much, of course; but one fellow ventured to remark that the exhaust steam formed a sort of piston in the stack and forced out a stackful at each exhaust. This looked reasonable, and all chimed in on it as being right.

"Perhaps it is," said the new man; "but let's take a look at a few figures from Sinclair's book on combustion. Taking the engine he mentions, running forty miles an hour, and it requires over 90 pounds of air per mile for every foot of grate, and about seventeen times this for the whole firebox, or, say, 1,190 pounds of air per mile, or about 15,500 cubic feet of air per mile.

"This is a pile of air to be pushed out in chunks by the exhaust; but perhaps your pump theory is right.

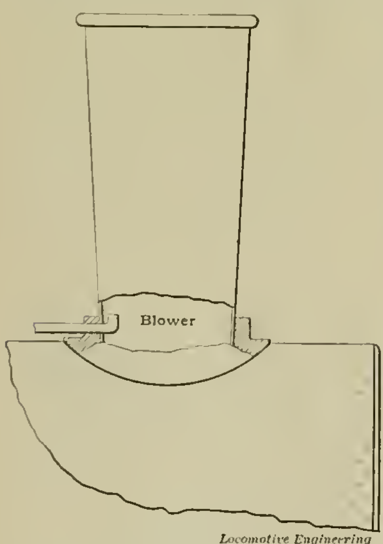
"If it is, what about the action of a blower? Does that always fill the stack, too; specially when it isn't central with the stack, as in lots of the old engines? Why, I've seen engines with the blower in the base of the stack and right at the side, and if the generally accepted angle of expansion for steam is correct, it didn't begin to fill the stack before reaching the top of the stack.

"It seems to me that the exhaust can be likened to a lifter or ejector, which creates draft by causing a vacuum in the front end, same as in the supply pipe of an injector. Seems as though the air was drawn out by the rush of the steam and by mingling with it; though of course there is just the same number of cubic feet to be handled this way as the other.

"When I see double stacks like Warren's in the January Locomotive Engineering, it seems to me that, at slow speed, the vacuum must make air flow in one stack, while the exhaust goes out the other and lessens the draft. Maybe it doesn't, but seems as though it ought to.

"It rather makes me smile to see men monkey with the blower in order to get it just so. Reminds me of the way they used to do years ago. The blower expert had the nozzle drawn down 'just so,' and a hundredth of an inch either way ruined it sure.

"One day I took an engine out to the Boston & Providence, and the blower seemed to lose its wind, so to speak—wouldn't raise breeze enough to blow out a candle. I thought it needed more drawing down, till I looked into one of their other engines. Then I took a pipe cutter and cut off the drawn-down part, leaving the full size of pipe. Wasn't any more trouble after that, and the 'drawer down' lost his job. The plain pipe would almost lift the grates; and, by the way, they were put in rather peculiarly, too—something like this," and he sketched the following on a board with a piece of chalk.



AN OLD BLOWER.

"They seem to think, generally," he continued," that the blower must be down in the smoke arch, but these worked all right, and kind of add a little more confusion to the question. I wish some of these chaps who know more about these things than I do, would enlighten us on the subject; for if a fellow has an inquiring mind at all, he isn't entirely satisfied with knowing it does 'so and so'; he wants to know why—at least I do."

Mr. Newcomer is thought more of than at first, although some of the men still think they know all about it.

R. E. Marks.

Camden, N. J.

Inventor of the Pressure Gage.

Editors:

We notice in your September issue of Locomotive Engineering, page 709, No. 69, a question is asked by your correspondent, F. C. P., Dayton, O., "Who invented the steam gage?" The indisputable answer is Sydney Smith, of Nottingham, in 1847. George Stephenson, the eminent locomotive engineer, was the person to try it, and so delighted was he with its working that he voluntarily sent his observations and opinion to most of the leading mechanical papers published in his day. We enclose herewith a copy of George Stephenson's letter, and no doubt, if you publish it, it will not only be of interest to F. C. P., but also to your numerous readers.

A full and accurate description of this first steam gage appeared in the columns of the *Mechanical World*, on August 6, 1897, page 7; also July 23, 1897, page 47; July 16, 1897, page 35; July 9, 1897, page 23. This paper, the *Mechanical World* (published New Bridge street, Manchester), was the first paper to take the matter up, and that is why you have the above information in it. A leading article on the same subject appeared in the *Railway Herald*, July 17, 1897, page 10. The Frenchman's gage was brought out three years after Sydney Smith, viz., 1850.

Mr. Sydney Smith has had no national recognition of the great benefit conferred upon mankind by this invaluable invention, except the fortune he made out of it. Perhaps your powerful pen may do something towards it.

Isaac Smith,
Son of the late Sydney Smith.

Nottingham, England.

We believe that the claim made for Mr. Sydney Smith being the inventor of the pressure gage to be well founded. The following is the letter from George Stephenson referred to:

"Tapton House, Chesterfield,
"October 15, 1847.

"A most important invention has been submitted to me for my approval, patented by a Mr. Smith, of Nottingham, and intended to indicate the strength of steam in steam engine boilers. It is particularly adapted for steamboats, and can be placed in the cabin, on deck, or any other part of the vessel, where it may be seen by every passenger on board. It may also be fixed in the office of every manufactory where a steam engine is used at a considerable distance from the boiler. I am so much pleased with it that I have put one up at one of my own collieries. It is some distance from the boiler—in another house—and works most beautifully, showing the rise and fall of the steam in the most delicate manner. The indicator is like the face of a clock, with a pointer, making one revolution in measuring from 1 pound to 100 pounds upon the square inch of the pressure of steam. It is quite from under the control of the engineer, or any other person, so that its indications may be relied upon, and the construction is so simple that it is scarcely possible for it to get out of order. I might give a full explanation of the machine, but I think it best to leave that to the inventor himself. The numerous and appalling accidents which have occurred from the bursting of steamboat boilers have induced me to give you these observations, which I think desirable to be laid before the public. I may state that I have no pecuniary interest in the scheme, but being the first person to whom it has been shown, and the first person to make use of it, I feel it a duty I owe to the inventor, as well as the public, to make it as universally known as possible. The indicator is put up at Tapton Colliery, near Chesterfield, and may be seen any day by any respectable person.

"George Stephenson."

Cover Your Inventions by Patents.

Editors:

The editorial on "Patenting Other People's Inventions," published in your January issue, calls to my mind a new provision in the United States statutes which you probably have not had occasion to examine. The provision referred to is a portion of Section 4921 contained in an act approved March 3d, 1897, which took effect the 1st of this year. The particular clause to which I have reference reads as follows:

"But in any suit or action brought for the infringement of any patent there shall be no recovery of profits or damages for any infringement committed more than six years before the filing of the bill of complaint or the issuing of the writ in such suit or action, and this provision shall apply to existing causes of action."

By the above salutary provision it is evident that the evil effects of some of the abuses in patent practice complained of in your article will be in the future materially decreased, for it will no longer be possible for any one to secure a patent, permit another to use an apparatus infringing such patent during all, or approximately all of the seventeen years' life of the same, and then bring suit and collect profits and damages for the whole period of time.

Of course, the above amendment in the statutes does not prevent any one who is willing to perjure himself from making application for, and in some cases securing patent protection upon inventions stolen from others. It is difficult to imagine how any one can be placed in a more exasperating situation than one in which he is called upon to pay royalties to another on an invention which he himself originally made.

Of course, the statutes which provide certain defenses against infringement suits contain a clause designed to cover the case in point, but this defense, which is that commonly known as "prior public use," is a very difficult one to prove, and unless the date of the prior public use can be carried back more than two years before the application date of the patent, even if satisfactorily proved, it will avail nothing.

There is, of course, still another provision in patent law which allows a man who believes himself to be the original inventor of a device which has been patented by another, to file an application and go through an interference proceeding with the issued patent, and if successful in the contest, secure a patent himself; but this does not invalidate the earlier patent, and the controversy still remains to be settled in the federal courts by a long, tedious and expensive law suit.

The obvious moral of all this seems to be that until and unless the statutes shall be amended in such manner as to remove all possibility of abuses of this nature, (which is something it seems very difficult to do), it behooves every man, woman and child, who makes a useful invention, to lose no time in securing proper patent protection thereon. This is the surest, and in fact the only reliable safeguard against such impositions as have been noticed by you.

PAUL SYNNESTVEDT.

Chicago, Ill.

"Setting Valves by Sound."

Editors:

When I responded to an article on the above subject by Mr. Rogers in October number, I did so under the impression that Mr. Rogers wrote the article for the benefit of locomotive engineers, who may feel disposed to try and "square" the valves of their engines while on the road, and who seldom have trams and indicators along for that purpose.

The object I had in view, in asking Mr. Rogers the questions I did in November number, was to bring out the reasons for making the changes he suggested, as I believe it equally important to know the cause of defects, as to know the remedy.

His answer in December number explains the principal cause, viz.: "The area of the valve stem multiplied by the steam pressure."

This reveals the secret of all the lost motion being one way. Knowing this anyone in trying to locate a leak, or strong exhaust, will watch the pins on back centers first, but if he did not know this, would experience some trouble in locating the defective exhaust readily and even then remain ignorant of the cause.

I cheerfully admit that I misconstrued the sense of Mr. Rogers' article, where he said "shorten all the eccentric rods an amount that will depend on conditions found."

In December issue Mr. John Jay attacks the subject with trams and indicator, and considers it "simply guess work." I admit that to a certain extent, and will vouch for Mr. Rogers doing the same, but I do think that if an engineer on the road can get down with his wrench and soft hammer, and in two minutes find four exhausts instead of three, he is a better guesser than the man that goes over the road with an indicator in his seat box and three exhausts in the stack.

Mr. Jay also brings up the difference in diameters of cylinders, ports and cavities, heads projecting over openings, main rods not a correct length. etc. I admit that Mr. Jay's idea of setting valves is superior to that described by Mr. Rogers, but not upon the same point. My article was upon the same plane of that of Mr. Rogers, and questions upon the same subject, but I cannot see where Mr. Jay has followed the subject, but instead he has "jumped the track" in the first part of his article, and "turned over" when he stopped to see how he fared at the hands of the publishers.

I have an indicator and trams, but could see no place to use them on Mr. Rogers' subject, but instead tried to follow the same as near as possible, and upon the same level, and am unable to see where Mr. Jay's article even touches upon the subject of "setting valves by sound." Mr. Rogers explained how to adjust the valve motion to make all exhaust sounds alike, and not to locate unequal diameters of cylinders, short main rods, etc.

W. W. PITTS.

Hillsboro, Tex.

[We think that no benefit will accrue to our readers by pursuing this discussion, so it is closed.—Ed.]

Improvements on the Panhandle.

Editors:

On December 27th the Panhandle connected the two ends of double track. This gives them double track from Pittsburg to Port Washington (104 miles); single line Port Washington to Newark (55 miles); double track Newark to Columbus (33 miles). This was a godsend to the men in train service, as the strip of single line, while short (six miles), was at a point that could not be worse. We frequently were delayed at ends of double track from one to three hours.

We are doing very good freight business. The following is the run we had on Pittsburg division from Saturday, 8th, midnight, to Sunday, midnight: Twenty-nine trains West, thirty trains East; total number of cars, 1,736, making about 50,000 tons. Before lake trade closed, the run of coal over Sheriden scales in twenty-four hours was 712 cars. This was their heaviest day's work.

The roundhouse force handles from forty to fifty engines every twenty-four hours.

W. H. HOLBROOK.

Dennison, O.

Welding Copper.

Editors:

Noticing your item in the December LOCOMOTIVE ENGINEERING referring to Messrs. Wyman and Gordon welding copper as something unusual, I have been welding copper, and copper to steel, for several years in my work on different roads of handling and doing repairs on engines. I have welded the split ends of copper tubes, and branch pipes, and in making soldering coppers I split a ½-inch steel rod and draw my copper to a wedge and close steel on copper and weld in a common open fire. Of course, I use a flux, but it is not a difficult feat by any means. I hope this will be of use to fellow workmen, and if they are interested will give flux used and proper heat and manner worked. Yours truly,

HARRY J. WHITE.

Beaumont, Tex.

Advantage of Good Boiler Covering.

We have always believed that good non-conducting covering for locomotive boilers was one of the most profitable investments which a railroad company could make with little extra expense. It is often difficult to bring exact facts in support of a theory, but we have stumbled upon excellent corroborative evidence of the value of good boiler covering. The authorities in charge of the engineering plant at Purdue University take very accurate notes of everything connected with their experimental locomotive. The first locomotive they had, "Schenectady No. 1," was lagged with wood, and it was noted that when the engine had the fire drawn at 5 P. M., the steam went entirely down by midnight. The new locomotive recently installed, "Schenectady No. 2," is lagged with Keasby & Mattison's magnesia sectional covering, and it conserves the heat to such an extent that there is always steam in the boiler at 9 A. M. This happens in a well-protected house. The difference in waste of heat in a locomotive rushing through the cold air may well be understood. This gives us a strengthened argument in saying, "Cover your boilers with material that keeps in the heat and is a sure protection from the refrigerating effect of cold air." Wood is cheap in first cost, and very expensive in the end.

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The January number of LOCOMOTIVE ENGINEERING was the largest edition of any railroad paper ever published. The paper alone weighed 37,530 pounds.

We have to apologize to a portion of our readers for the delay in the delivery of our January number. When a large part of our issue had been mailed, the Post Office people found out that the flap on the cover was contrary to a "department ruling," and they stopped the remainder until the flap was cut off. This caused considerable delay, and explains the late delivery in some places.

Force and Resistance.

In mechanics, the term work—by which is meant the overcoming of a resistance through a space—is one of the most important of the principles of that science. On a proper understanding of it depends much of the success of the beginner in engineering, whatever branch is undertaken, for no matter what agent may be taken to do the work, whether steam, electricity, compressed air, or hydrodynamics, all must do work in overcoming resistance. This proposition implies motion, since motion must ensue before resistance can be overcome; therefore without motion work cannot be done.

The foot-pound, the unit of work, is a resistance of one pound overcome through a distance of one foot. Work is therefore a resistance overcome through a distance, and is represented in amount by the resistance in pounds multiplied by the distance in feet through which it is moved. The product of the resistance by the distance overcome, must be equal to the product of the power by the distance through which it acts. Thus a force of 100 pounds acting through a distance of 10 feet will do $100 \times 10 = 1,000$ foot-pounds of work, and it will overcome a resistance of 100 pounds through a like distance since their products are equal; but, the same force may be made to overcome a greater resistance by moving it through a lesser space, as,

$$\frac{100 \times 10}{5} = 200,$$

showing that 1,000 foot-pounds of energy has overcome a resistance of 200 pounds through one-half the distance moved by the force. This action is exemplified by the principle of moments as in the lever, where a force of 100 pounds on a ten foot lever arm will be equal to a resistance of 200 pounds on a five foot lever arm.

No account has been taken of the element of time in the above examples, since it is plain the work may be done in one day or any other division of time, but note must be taken of time in order to establish the rate at which power is overcoming a resistance, or what is the same thing, doing work. The unit of time is represented by one minute, and the unit of power—the horse-power—is 33,000 foot-pounds of work done in one minute, then by the definition,

$$\frac{\text{ft.-lbs. of work per minute}}{33,000} = \text{horse-power.}$$

This expression is the base of all calculations in the determination of power development. In the case of an engine with a cylinder 8 inches in diameter and 12 inches stroke, having an effective steam pressure of 50 pounds per square inch, and running at 300 revolutions per minute, the foot-pounds of work done in one minute equals pounds pressure on the piston multiplied by the distance in feet through which the force acts on the piston during 300 revolutions. This is found by multiplying together the area of the piston, the effective steam pressure, the feet in a double stroke, and the revolutions per minute, and will be seen to equal $0.7854 \times 8^2 \times 50 \times 2 \times 300 = 1,507,968$ foot-pounds of work per minute. The horse-power is then found to be equal to

$$\frac{1,507,968}{33,000} = 45.69$$

This power is gross, or that put on the piston, but it does not follow that it is all given out in useful effort; the net power is that found above, minus friction in the engine and to the point of delivery. In this case we assume that there is no friction.

The units of energy per minute thus found to be exerted by the engine show at once its capacity for doing work. Taking an electric light plant as a practical example, representing a certain resistance to be overcome, the 1,507,968 units of energy of the engine stand as the exponent of the amount of work that can be done, and since the power must equal the resistance it is plain that a resistance of 1,507,968 pounds can be overcome through a space of one foot in one minute. It has been found that ten 16-candle power incandescent lamps offer a resistance of about one horse-power; one such lamp would therefore have a resistance of one-tenth of a horse-power, or,

$$\frac{33,000}{10} = 3,300 \text{ foot-pounds,}$$

and from this data the number of lamps capable of being handled by the engine would be equal to

$$\frac{1,507,968}{3,300} = 457 \text{ lamps nearly.}$$

In the event that an engine is required to drive such a plant, the power needed is quickly determined from the known resistance of 457 lamps. This is seen to be equal to $475 \times 3,300 = 1,507,968$ foot-pounds per minute, which is, as has been shown, equal to 45.69 horse-power.

The work done during one revolution of the engine under consideration, is equal to the area of piston, mean effective pressure, and the number of feet through which the force is exerted in one revolution multiplied together, or, $0.7854 \times 8^2 \times 50 \times 2 =$ 5,026.56 foot-pounds—not per minute, but just one revolution, and this will, of course, represent the resistance that will be overcome during one revolution, neglecting friction as before. If, now, the driving pulley on the engine is 5 feet in diameter, its circumference will be 15.7 feet, and while the piston is doing 5,026.56 foot-pounds of work in two strokes, it is overcoming a resistance of

$$\frac{5,026.56}{15.7} = 320.16 \text{ pounds}$$

at the circumference of the pulley. This resistance represents the pull in pounds on the belt transmitting the power from the engine, and if the engine were a locomotive, these figures would mean draw-bar pull, or tractive power.

The effect of increasing or diminishing the diameter of the driving pulley is made apparent by dividing this work done by the engine in one revolution by a pulley, say twice the diameter and therefore twice the circumference of the one considered; then

$$\frac{5,026.56}{31.4} = 160.08 \text{ pounds,}$$

which is seen to be one-half of that found in the first case, showing that while the engine is doing 5,026.56 foot-pounds of work in one revolution, the belt is overcoming a like resistance at the same time, for $160.08 \times 31.4 = 5,026.56$ foot-pounds. The revolutions of the engine were taken at 300 per minute for the first pulley, and running at the same speed for the larger one, we find $5,026.56 \times 300 = 1,507,968$ foot-pounds of work done per minute as in the first case with a pulley only one-half the diameter of the latter. This is apparently a mixed situation, but it explains itself when the peripheral speed and load of the two pulleys are compared. The speed at circumference of the 5-foot pulley is 15.7 feet ×300=4,710 feet per minute, while the 10-foot pulley is 31.4×300=9,420 feet per minute, but the small pulley overcomes a resistance of 320.16 pounds, while the large one overcomes a resistance of only one-half that, or 160.08 pounds; the circumferential speed of the latter is twice that of the former, but the loads are inversely as the diameter, and this equalizes the products of the resistances, and distances traveled by the two pulleys. It is simply an illustration of the principle of virtual velocities.

This increase in diameter of pulley has shown a decreased pull on the belt, just one-half, in fact, and it is well to keep in mind the reasons therefor. The large pulley will transmit twice the power with the same belt and number of revolutions. If the resistance is the same in both cases as has been shown, and the belt pull is less, then it is plain that there is less strain on the journals and hangers as well as on the belt, and an improved condition of things is felt in all directions. This, however, has its limitations and cannot be carried to excess, for there is a danger point for the speed of pulley, and also a belt speed beyond which there is no economy; centrifugal force is the barrier in both instances.

A Weak Point In Our Locomotive Building Shops.

Our leading article in the December issue, entitled "How We Are Becoming the Locomotive Builders of the World," was published in several European papers, and has excited a great deal of discussion. Some of the European engineers were inclined to question the correctness of our statement, that locomotives can be built cheaper in this country than anywhere else, but when locomotive builders abroad were interviewed on the subject, they were moved to admit that our statement was correct.

The writer of the article in question has had considerable extra correspondence on account of the statements made, and one point raised by several of the correspondents is worthy of consideration. That was that the machinery of American locomotives is as good as anything built; but the boiler generally is so poor, that it is cheaper in the end to pay much more for an English locomotive than for the same machine turned out of an American shop. This was by no means new to us, for we had frequently seen the complaint made in newspaper controversy about the merits of British and American locomotives. It is a case where much smoke indicates some fire, and we certainly think that our locomotive builders reaching out for foreign trade should use every endeavor to make as good a boiler as any of their rivals produce. We have no doubt whatever but the poor boiler work turned out results from the inferiority due to the injudicious pushing of the piece-work system.

There is a great deal of a boiler maker's work that is easily covered up and beyond detection of inspectors. To prevent a boilermaker slighting a job when he wants to would require an inspector behind every workman. Most of our locomotive builders are now drilling holes and otherwise improving their methods of boiler making, but we think that the greatest improvement they could carry out would be to put an end to piece-work on the vital parts of a locomotive boiler.

Utility of Small and Large Locomotives.

There has been considerable discussion lately in railroad meetings about the best form and size of locomotive for ordinary railroad service, and quite a diversity of opinion has been expressed. In the course of a talk made at the Southwestern Railroad Club, Mr. G. W. Rhodes expressed a liking for the eight-wheel American engine with cylinders about 17 or 18 x 24 inches. We believe that were all the men in the country connected with the operating and repairing of locomotives to be asked what form of an engine they would prefer, that about 95 per cent. would favor the medium-sized eight-wheeler. We believe that, for its inches and capacity, it is the most efficient and satisfactory all-round engine ever used. The proportions can be made almost ideal for a gage of 4 feet 8½ inches; the engine is easy to handle convenient to repair, is fairly light on fuel, and is not destructive to track and bridges. But, with all its good points, the 18x24-inch eight-wheeler is going the way that the admirable 15 x 22-inch engines of twenty-five years ago have gone. The transportation side of the railroad household keep increasing the weight of trains, just as their fathers did a quarter of a century ago, and the motive-power men must find engines with sufficient power to pull the trains. This has brought forth the monster eight-wheelers with about 90,000 pounds resting on four journals, the immense ten-wheelers with greater power than the early consolidation engines, and the big-wheeled mogul of almost equal capacity.

There is no doubt that the movement in favor of very heavy locomotives will never swing backwards again, but it cannot advance much further, for the greatest size of an engine that can pass under a 15-foot bridge has been reached. Railroad companies are not likely to raise their bridges and raise the roof of their tunnels to enable locomotive designers to push the boiler still further from the rail, and thereby increase its size, nor are they likely to spread the track so that a big boiler could be placed between the driving wheels.

Locomotives of maximum size will be the future motive power for trunk lines, because when fully loaded they reduce the cost of moving freight and passengers. But they must pull a full load to give better results than a smaller engine. This fact does not seem to be properly understood by some motive-power men. They hear the oft-quoted remark made, that heavy engines reduce the cost of train haulage, and they do not discriminate about what kind of a train the heavy engine is coupled on to. All over the country we find very heavy locomotives used now and again to pull trains that engines of one-half the capacity could handle quite easily. When this is done, the heavy engine is just as wasteful as if an engine were employed that had to work up almost to its maximum capacity to pull the train.

In this connection we think that the 17 and 18-inch engine has not received the attention it deserves in the designing of locomotives for train service that is not very heavy. Within the last few years steam pressure has been raised from 140 to about 200 pounds to the square inch, but the smaller cylinder engines have seldom got the higher pressure to work their pistons. If a little larger boiler were put on, and the driving wheels made sufficiently large to prevent the engine being slippery, we believe that the small cylinder eight-wheel engines would redeem their reputation and perform work that heavier engines are now doing, and do it much more economically. The matter is worth careful consideration. Those who are always ready to follow a fashion without reflection commit many blunders.

Strengthening and Weakening Staybolts.

A rather ingenious plan has been adopted by Mr. William Buchanan, superintendent of motive power of the New York Central, as a means of keeping staybolts of boilers in safe condition. He punches a ⅛-inch hole about 1 inch deep in the outside end of the staybolt before the thread is cut. The belief is that this act of punching compresses the iron somewhat and makes it stronger at the point where breakage generally takes place. The holes are all carefully cleaned out after the staybolt has been riveted, so that leakage will indicate when a staybolt has broken. The mechanical department of the New York Central have been always very particular about the kind of material they use for staybolts, and indeed for every part of the boiler. The immunity which the company has enjoyed from serious boiler accidents has been no doubt due in a great measure to the careful selection of material and rigid inspection of the workmanship.

The high steam pressure which is becoming the rule for locomotive boilers is moving master mechanics to do all in their power to prevent the breaking of staybolts, or to provide means of immediately detecting breakage when it happens. Under this sentiment, the hollow staybolt is coming steadily into use, but not so fast as it ought to. Some roads are reducing the diameter of the staybolt in the middle, with the view of giving it elasticity. That may be a good plan, but we do not think it can be followed safely unless the staybolt is hollow. If the middle part of the bolt is reduced until it is the weakest point, some means should be provided to indicate when it breaks. Drilling holes in the ends would not be of any use. On the whole, we think that weakening the middle of the staybolt is a doubtful expedient for promoting safety. It would probably make the bolt endure better the movement and strains of service; but it reduces the strength of the bolt as an anvil when a dolly bar is pressing on one end and a heavy hammer raining blows at the other. Those who have reduced the middle of the staybolt to the same diameter as that between the bottom of the threads, have found it a good practice; but reducing it below that diameter is likely to bring about a new source of danger.

Delusive Examinations for Promotion.

In our travels among the railroad officers on this continent, efforts are frequently made to excite our sympathy on account of the difficulties encountered in getting train men to take an intelligent interest in their business, an interest that will induce them to study the purpose of train mechanism. There are so many devices about cars and locomotives nowadays that will not be cared for properly, unless the train men understand their construction, that nearly all railroads are subjecting their train men to an examination before permitting them to be entitled to promotion. Railroad companies cannot be blamed for doing this, as it is a measure of self-protection. There is a great deal of opposition among a certain class of train men to the "examination" wall that stands between them and promotion, and they talk loudly about having it taken down, but it persists in remaining standing, and is all the time extending.

While we consider it no hardship to require men to be examined, we have the best of reasons for believing that the officers of some roads use the examination as a means of inflicting injustice; but cases of the kind are not common. A bright, intelligent man who has made a practice of studying the details of train mechanism and of the scientific principles of his business, goes up for examination and is rejected—has failed to pass. Another, known among his friends as an ignoramus, goes to the examination and fails to answer any question properly, yet is declared eligible for promotion. He has not passed upon merit, but because he belongs to the same political party, lodge or church that the examining officers affiliate with. This has a very demoralizing effect upon railroad service, and is prejudicial to the interests of railroad companies. Of course there are many groundless complaints, because men are prone to overestimate their own knowledge and to underestimate that of others.

Where there are charges circulated that the examinations are not conducted or adjudged fairly, examiners, for their own vindication, should adopt the practice recommended by the Traveling Engineers' Association in the following rule:

"Applicants for second examination will be permitted to bring one or two witnesses to attend the examination; said witnesses to be engineers who have successfully passed the examination."

That rule might be very judiciously applied to all examinations. It is a very simple and efficient way of putting an end to charges of unfairness in the examination of candidates for promotion.

There was another resolution proposed and adopted by the Traveling Engineers' Association which would have greatly improved the personnel of enginemen, had it been followed by railroads generally. It reads:

"It is the opinion of this association that firemen should be hired on probation for the first six months, they being given to understand, when entering the service, that, for cause, they are subject to be discharged without question before the end of six months."

There are many men who secure jobs as firemen who will never make good engineers. This is not for want of intelligence, but because they lack the physical and mental qualities necessary in the make-up of a good engineer. The railroad officers ought to have the opportunity to pass judgment upon the qualifications of the men before the latter can establish "rights" to pass for promotion.

Reverse or Not Reverse.

A minor question of what is best to do in the operating of locomotives has been raised lately by a correspondent of the *Railroad Gazette*. This correspondent wishes to know which practice is correct—reverse the engine, or do not reverse, when the driver brake has been applied. Forney and Sinclair are given as authorities in favor of reversing under certain circumstances, and the Westinghouse Air Brake Company are cited as being opposed to reversing under any circumstances when the driver brake is applied. This looks like a conflict of authorities, but it really means only that the Westinghouse people are more nearly up to date than the other two. When Sinclair wrote his book on "Locomotive Engine Running and Management," the driver brakes in use were very inefficient aids to stopping the train, and the author advised engineers to depend more upon reversing in an emergency, but to watch the driving wheels, and if they began to slide, to release the brake or open the cylinder cocks, which latter in itself generally had the effect of letting the wheels begin to revolve again.

Things are very much changed in the use of driving brakes nowadays. The brake is so powerful that reversing is almost certain to cause sliding of driving wheels, unless the train is running at a very high speed. The co-efficient of friction between brake shoes and revolving tire is so much lower at high velocities that reversing may be practiced safely in the beginning of a stop, if the engineer is cool and sufficiently under self-control to judge the instant when the reverse lever should be moved in front of the center. But the average engineer is not sufficiently cool in emergencies to watch the movement of the driving wheels, and therefore we would say that the safe practice in an emergency was to apply the brakes for all they were worth, open the sand valves and depend upon the forces at work to make a quick stop.

Tonnage Rating.

A very valuable paper on Tonnage of Trains was contributed by Mr. L. R. Pomeroy to the January meeting of the New York Railroad Club. Mr. Pomeroy has devoted a great deal of labor and research to the subject, and his paper contains particulars of all the different systems of tonnage rating that are in use.

If any railroad manager is contemplating the introduction of the tonnage system, he ought to study Mr. Pomeroy's paper. Rating a train by the number of tons in it is certainly the fairest way all round, both for the interest of the company and for the trainmen. One of the speakers at the club meeting made the amusing point that when he was an engineer he always preferred to take a train loaded with straw hats, and leave the ore and coal for the other fellow. That is the way all round. With the ton rating system it does not matter who gets the straw hats and who gets the coal. They have the same weight of coal to haul anyhow.

There seems to be a wide-spread belief that within a few years there will be no more talk of car mileage, and that the loads of all locomotives will be made out according to tonnage.

This is a change very much to be desired, but those who are sanguine about its immediate adoption leave one individual out of account who has very great influence concerning train matters. That is the yard master. Our experience with yard masters is that they are more autocratic than the president, and have their own way, no matter what orders they may receive. If yard masters could be abolished, a great step would be made towards the introduction of the tonnage system; but as they cannot be abolished, the car-mile system will hold its own much longer than the friends of the other plan anticipate.

Receivers as Violators of Law.

With the return of prosperity to the country the railroads that have been in the hands of receivers have begun slowly to reorganize and return to be operated upon a business basis. A curious experience has been gone through with the numerous receivers in charge of railroads for the last four years. A receiver of a railroad is an officer appointed by the United States courts, and is responsible to certain judges for all his acts in the management of the property. This being the case, it might naturally be supposed that a receiver would be extremely careful to adhere to the laws relating to transportation, yet the reverse has been the case. Receivers have been the most flagrant violators of the Interstate Commerce laws, and their masters, the judges, appear to have done nothing to check the demoralizing of rates that resulted.

Some Western railroads have been for years ballasting their tracks with a material made from burned clay, which is popularly known as "gumbo." Gumbo resembles broken bricks indifferently burned, and many railroad engineers favored its use for a time, but it manifested a decided tendency to return to its original element—clay—and for that cause it is becoming unpopular. The Chicago, Rock Island & Pacific people now propose putting crushed rock under the ties, and gumbo between them. This is a compromise which, like nearly all compromises, with sin and otherwise, is of doubtful utility. We know something about the ballasting of tracks, and we would say to the Rock Island people, stick to gumbo or put in unadulterated rock. If you try the combination, the rock and gumbo will mix every time a tie is raised or changed, and you will have neither a good rock foundation nor a bed of gumbo whose shortcomings are recognized.

"Mechanical Draft" is the title of a very comprehensive treatise on this subject which has just been issued by the B. F. Sturtevant Co., of Boston, Mass. It is a 385-page book, and presents the latest and best ideas on the subject to be found anywhere. It, of course, advocates mechanical draft in preference to the so-called natural draft of chimneys, and gives a great amount of data in support of this, which is extremely valuable to those interested in power plants. The author, Mr. Walter B. Snow, deserves credit for making such a readable volume, and the Sturtevant Co. are to be congratulated in bringing out such a useful book. It will, we presume, be sent to superintendents, master mechanics and others who are entitled to it.

Part 9 of J. G. A. Meyer's "Easy Lessons in Mechanical Drawing and Machine Design" is particularly interesting to engineers, as it deals largely with eccentrics, eccentric rods and other parts of engines, which, while not especially representing locomotive practice, is still very similar. These lessons are written in Professor Meyer's usual manner, which has seldom been equalled in any of the many attempts at self instruction. He has the faculty of making a subject very clear and interesting to a mechanic, and we feel sure that these lessons will prove a valuable addition to the literature on this subject. They are published by the Arnold Publishing House, 16 Thomas street, New York City.

During the hard times, happily passing away, there was little inclination displayed by large railroad companies to swallow up the small ones, and by the usual methods of consolidation build up huge, unwieldy systems. They were more inclined to drop unprofitable companies, and let them meet their own deficiencies of revenue. But the mania for consolidation is again manifesting itself. "Feeders" that draw from net earnings instead of adding to them, are being absorbed by the big roads, and history will repeat itself in a new crop of receivers when the season of poverty returns again.

We have received a letter from an anonymous correspondent in Memphis, Tenn., abusing railroad officers to the extent of about a column of our reading matter. We advise the correspondent who wrote the letter to write another one of the same kind and send it direct to his master mechanic with his proper name signed to it. We do not propose to let anybody abuse others or anything in Locomotive Engineering, when they do not have the manliness to sign their name to the letter.

A railroad man belonging to one of the principal trunk lines of the country, in renewing his subscription to Locomotive Engineering, says: "I cannot get along without the paper, and I might also say that every one of the firemen who have been promoted for the past two years on this division have been regular subscribers to Locomotive Engineering."

PERSONAL.

Mr. John W. Dickinson has resigned as superintendent of the Gulf, Colorado & Santa Fe.

Mr. W. K. Morley, superintendent of the Kansas City, Pittsburg & Gulf, at Texarkana, Texas, has resigned.

Mr. T. H. Curtis has been appointed assistant superintendent of the New York, Chicago & St. Louis, at Cleveland, O.

Mr. F. M. Raike has been appointed assistant general manager of the Texas Midland Railroad, with office at Terrell, Tex.

Mr. Horace G. Burt, third vice-president of the Chicago & Northwestern, has been elected president of the Union Pacific.

Mr. Henry W. Gays, general manager of the Chicago, Peoria & St. Louis, has moved his office from Springfield, Ill., to St. Louis, Mo.

Mr. W. G. Potts has been appointed superintendent of the Sierra Railway of California, vice Mr. E. T. Albert. Headquarters at Oakdale, Cal.

Mr. Daniel Lamont, of Munising, Mich., has been appointed round house foreman for the Munising Railway, and branch lines, of Michigan.

Mr. Edgar Van Etten, general superintendent of the New York Central & Hudson River, has been chosen president of the Randsburg Railway of California.

Mr. W. J. Parker, superintendent of the Western Railway of Guatemala, has resigned, and Mr. Louis Larrean, cashier of the road, has been appointed acting superintendent.

Mr. W. C. Hollister, formerly with the Atchison, Topeka & Santa Fe, has been appointed superintendent of the El Paso & Northwestern, with headquarters at El Paso, Texas.

Mr. P. W. Fearing, foreman car builder of the Air Line shops in Princeton, Ind., has resigned to accept a position with the Missouri Car and Foundry Co., of St. Louis, Mo.

Mr. Abraham Ouellette has been appointed superintendent of the Quebec & Ste. Flavie branch of the Intercolonial Railway. Headquarters at Riviere du Loup, Que.

Mr. F. A. Seabert, assistant division superintendent of the Southern Pacific at Tucson, Ariz., has been appointed superintendent of the Redondo Beach at Los Angeles, Cal.

Mr. W. McLane, late of the Plant System, has accepted the position of master mechanic of the Bellington Bay & British Columbia Railroad, with headquarters at New Whatcom, Wash.

Mr. William B. Norton, traveling engineer of the Northern Pacific Railway, had both his legs crushed by a locomotive tender, and it is feared that amputation of both legs will be necessary.

Mr. F. Mertsheimer, superintendent of motive power and equipment of the Kansas City, Pittsburg & Gulf, has been made general superintendent, with headquarters at Kansas City, Mo.

Mr. H. E. Hutchins, assistant superintendent of the Atlantic & Danville, at Norfolk, Va., has been appointed superintendent and the office of assistant superintendent has been abolished.

Mr. Hiram R. McCullough, general traffic manager of the Chicago & Northwestern, has been made third vice-president of that road, succeeding Mr. H. G. Burt, with office at Chicago, Ill.

Mr. G. H. Frech, trainmaster of the Central of New Jersey at Jersey City, has been promoted to the position of superintendent of the Central division of that road, vice Mr. W. H. Peddle, resigned.

Mr. C. Millard, superintendent of the St. Louis, Chicago & St. Paul, has been appointed superintendent of the Chicago, Peoria & St. Louis, succeeding Mr. H. S. Rearden. He will hereafter be superintendent of both roads.

Mr. W. H. Peddle, superintendent of the Central division of the Central of New Jersey, has resigned to accept the position of general superintendent of maintenance of the Southern Railway, with headquarters at Washington, D. C.

Mr. R. Fitzgerald, general superintendent of the Union Stock Yards and Transit Co., of Chicago, has resigned to accept the position of general superintendent of the Chicago, Hammond & Western, with headquarters at Hammond, Ind.

Mr. W. E. Green, general superintendent of the Chicago, Hammond & Western, has resigned to accept the position of general superintendent of the Southern division of the Kansas City, Pittsburg & Gulf, headquarters at Texarkana, Texas.

In our January issue we published a notice saying that we would give 25 cents each for copies of our August numbers of last year. The notice has brought so many responses that we now have more August numbers than we need, and we cannot take any more.

Mr. T. C. Sherwood, general manager of the Kansas City & Northern Connecting, has resigned, to engage in other business, and the title has been given to Mr. Robert Gillham, general manager of the Kansas City, Pittsburg & Gulf, of which system the Kansas City & Northern Connecting is a branch.

Mr. James Meehan has been appointed superintendent of motive power and machinery of the South Carolina & Georgia, headquarters at Charleston, S. C., vice Mr. J. H. Green, resigned. Mr. Meehan was formerly in that position, and left it to engage in private business in Mexico. We welcome him back to the railroad We welcome him back to the railroad fold.

Mr. E. E. Davis, assistant superintendent of motive power of the Reading, has designed an attachment to the Vauclain compound locomotives which prevents the cylinder cocks from being closed when the engine is working simple. It is strange that an attachment of this kind should be necessary, but it has done more to stop running the compounds simple than all the orders ever issued.

The regular quarterly meeting of the directors of the Davis & Egan Machine Tool Co., Cincinnati, was held on January 12th. The officers of the past year were re-elected: Chas. Davis, president; W. H. Burtner, vice-president and treasurer; B. B. Quillen, secretary and general manager. A dividend of 3 per cent. was paid to all stockholders, out of the earnings for the past three months, making a 12-per-cent. dividend for the year.

Nearly all the people who have been in the habit of attending the Master Mechanics' Convention will be pained to learn that B. R. Harding, of the Seaboard Air Line, has passed away. Mr. Harding was one of the most regular attendants of the convention, and could always be seen taking part in the proceedings. Mr. Harding was born in Virginia in 1832, and learned the machinist trade in the Norfolk Navy Yard. He left that to accept a position on the Wilmington & Waldon Railroad. During the war he was in the naval service of the Confederacy. When peace returned, he went back to railroad life, and died, as it were, in harness.

At present writing it seems practically certain that Congress will pass an anti-scalping law which will be of great benefit to the railroads in the United States. In the work done towards promoting the passing of this law, Mr. George H. Daniels, the energetic general passenger agent of the New York Central, has taken the lead. We believe that his efforts have done more to bring about a sound public opinion concerning ticket scalping than the efforts of all other railroad men combined. It will certainly be a great truimph for Mr. Daniels and for the great railroad he serves when the anti-scalping law finds a place on the statute book.

The stockholders of the Chicago Pneumatic Tool Co. held their annual meeting on Jan. 11th, and elected J. W. Duntley, president; J. F. Duntley, vice-president, and Le Roy Beardsley, secretary and treasurer, and declared a quarterly dividend. This company have received cable orders from Europe, since Jan. 1st, for 30 No. 2 hammers, 30 No. 3 piston air drills and 5 of their pneumatic riveters, and did over twice the business in 1897 that they did in 1896, and December, 1897, was the largest month in the year, showing that their business is daily increasing. From the outlook, January of this year will be larger than any month last year.

The following changes have been made on the Louisville & Nashville: Mr. W. S. Martin, superintendent of the Louisville division, with headquarters at Louisville, has been transferred to Evansville, Ind., succeeding Mr. B. F. Dickson as superintendent of the St. Louis & Henderson division; Mr. B. M. Sparks, assistant superintendent of the South & North Alabama and Birmingham Mineral division, with headquarters at Birmingham, succeeds Mr. Martin as superintendent on the main line; Mr. J. L. Welch, trainmaster at Birmingham, succeeds Mr. Sparks, and Mr. John R. Wheeler, trainmaster of the South & North Alabama division, succeeds Mr. Welch.

A variety of circumstances and performances have made Nat Sawyer, who was in charge of the New York Central's "999" at the World's Fair, a man of international celebrity. For several years Nat has retired from the excitement of locomotive running to the repose of running locomotive runners, which he performs with coolness and comfort never before known to that particular duty. Recently a person of an inquiring mind in Ireland wanted to communicate with Nat about the prospects of getting a job on a railroad in the United States, and he addressed a letter, "Nat Sawyer, Engineer or Something of That Sort on a Railway in the United States." Nat got the letter all right, which is good testimony in favor of our Post Office officials.

Railroad men are not very well posted about the leaders of their business, who have not heard of Dr. C. B. Dudley, chemist of the Pennsylvania Railroad at Altoona, Pa. Although still comparatively a young man, Dr. Dudley was the precursor of the railroad chemist. In connection with his retiring from the position of president of the American Chemical Society, an exchange says: "Charles B. Dudley was born in Oxford, July 14, 1842; fitted for college in Oxford Academy; entered Yale in the Academical Department in September, 1867, and was graduated in 1871. In the fall of 1872 he entered the Sheffield Scientific School of Yale, from which he was graduated in 1874 with the degree of Ph. D. The next year was spent as assistant to the professor of physics at the University of Pennsylvania, Philadelphia, and on November 11, 1875, he went to Altoona as chemist to the Pennsylvania Railroad Company, a place which he has occupied since that date. Among scientists Dr. Dudley is recognized as one of the best authorities on the testing of iron and steel. His investigations in that line some fourteen years ago completely revolutionized certain ideas which were then held, and established the fact that milder and purer forms of steel were better adapted to the construction of rails for railways than the harder steels and than those possessing greater tensile strength."

EQUIPMENT NOTES.

The Pullman Car Company are building 400 freight cars for the Duluth, Missabe & Northern.

The Ensign Manufacturing Company are building 300 freight cars for the Norfolk & Western.

The Chicago, Milwaukee & St. Paul are building 2,000 box cars in the West Milwaukee shops.

The Moseley Bros., refrigerator line, are having twenty cars built by the Wells & French Company.

The Jackson & Woodin Car Company are building 300 freight cars for the Erie & Wyoming Valley.

The Pennsylvania Refrigerator Company are having twenty-five cars built at the Erie Car Works.

The Omaha, Kansas City & Eastern are having 300 freight cars built by the Terre Haute Car Company.

The Colodado & Northern are having four passenger cars built by the Barney & Smith Car Company.

The Pittsburg Locomotive Works are building two six-wheel connected engines for the Union Railway.

The Pullman Palace Car Company are building 300 freight cars for the Chicago Great Western Railway.

The St. Louis Refrigerator Company are having 125 cars built by the Missouri Car & Foundry Company.

The Astoria & Columbia River are having ten passenger cars built by the Barney & Smith Car Company.

The Schenectady Locomotive Works are engaged on ten six-wheel connected engines for the Grand Trunk.

The Terre Haute Car & Manufacturing Company are building 650 freight cars for the Chicago & Northwestern.

The Hoshiu Railway of Japan are having four six-wheel engines built at the Pittsburg Locomotive Works.

The Rogers Locomotive Works are building fifteen ten-wheelers for the Intercolonial & Great Northern.

The Baldwin Locomotive Works are building four six-wheel connected engines for the Pittsburg & Lake Erie.

The Brooks Locomotive Works are building ten six-wheel connected engines for the Wisconsin Central lines.

The Pittsburg & Lake Erie are having four six-wheel connected engines built at the Brooks Locomotive Works.

The Central Railroad of New Jersey are having six passenger cars built by the Wason Manufacturing Company.

The Denver & Rio Grande are having two six-wheel connected engines built at the Baldwin Locomotive Works.

The Barney & Smith Car Company are engaged on an order for four passenger cars for the Southern Pacific.

The Esquimault & Nanaimo are having one six-wheel connected engine built at the Baldwin Locomotive Works.

The El Paso & Northern are having three six-wheel connected engines built at the Baldwin Locomotive Works.

The Charleston & Western Georgia are having five six-wheel connected engines built at Baldwin Locomotive Works.

The Mather Stock Car Company are having fifty-seven cars built by the Indianapolis Car & Foundry Company.

The Michigan Central Railroad Co. are about to build seven ten-wheel engines in their shops at Jackson, Mich.

The Boston & Maine Railway are having ten six-wheel connected engines built at the Schenectady Locomotive Works.

The Kanawha & Michigan Railway are having three six-wheel connected engines built at the Baldwin Locomotive Works.

The St. Louis, Peoria & Northern Railway are having two eight-wheel engines built at the Baldwin Locomotive Works.

The Atchison, Topeka & Santa Fé are having five eight-wheel connected engines built at the Dickson Locomotive Works.

The Canadian Locomotive Works have received an order for ten locomotive tender tanks from the Canadian Pacific Railway.

The Baldwin Locomotive Works are building fifteen six-wheel connected engines for the Kansas City, Pittsburg & Gulf.

The Northern Pacific Railway are having sixteen six-wheel connected engines built at the Schenectady Locomotive Works.

Three consolidation engines for the Pittsburg & Lake Erie are under construction at the Pittsburg Locomotive Works.

The Rogers Locomotive Works are building three six-wheel connected engines for the St. Joseph & Grand Island Railway.

The St. Charles Car Company have received an order from the Wabash for two handsome dining cars, and from the Iowa Central for four coaches and two chair cars.

The Baltimore & Ohio are having 750 freight cars built by the Missouri Car & Foundry Company, and 1,500 freight cars built by the Michigan Peninsular Car Company.

The Cincinnati, Hamilton & Dayton are having a large order of freight cars built,, divided as follows: 1,000 at the Barney & Smith Car Works, and 500 at the Michigan Peninsular Car Works.

The Richmond Locomotive and Machine Works have received an order for fifteen compound consolidation locomotives for the Canadian Pacific Railroad. They will be heavy and of the most modern design.

The Wabash are having thirty-one six-wheel connected engines built; twenty-six of these engines are being constructed at the Richmond and Baldwin Works, orders being equally divided, and the Pittsburg Locomotive Works are building five.

"Reminiscences of a Railway Engineer."

The fifth lecture in the series of railroad lectures was given in Purdue chapel yesterday morning at 10:30 o'clock by Angus Sinclair, of New York city. The speaker was introduced by Prof W. F. M. Goss as the editor of the technical magazine, LOCOMOTIVE ENGINEERING, also "the man who now runs all the locomotives in the country." Mr. Sinclair did not wish his lecture to be looked upon as one aiming at instruction, but rather as one of entertainment. A number of incidents were related to show that it was a very natural thing for him to become an engineer; in that the time of his birth was one when all the town was highly excited over the introduction of a new railroad. Also, by following in the footsteps of his father, who was an engineer, his profession was adopted. As an apprentice under William Laurie, the best firebox patcher in Scotland, Mr. Sinclair's powers of observation were keenly sharpened and he was taught a wonderful self-reliance. An interesting description was given of his first trip as fireman, which was made in a blinding snowstorm, as was also his last run as a locomotive engineer. Looking back upon his early hardships, the speaker seemed to refer to them as mere ordinary occurrences.

Mr. Sinclair seemed to regard the feeling of responsibility and absorption in his work to be uppermost in the engineer's mind, rather than the mere desire for money. Duty is the one thing commanding the most attention to the sacrifice of all that is most dear. The different way in which railroad mishaps are looked upon here and in the British Isles was given, showing that the American travelers are much more lenient and in sympathy with the engineer than they are across the water.

Every anecdote related by the speaker served not only to entertain for the time being, but to bring out some point which would be greatly helpful in practical engineering life. Throughout the lecture, great stress was put upon close application, patience and thoroughness in the discharge of duty, by one who would wish to excel and become truly successful in his chosen work.—Lafayette *Morning Journal.*

WHAT YOU WANT TO KNOW.

Questions and Answers.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(13) A. A. L., Oscaloosa, Ia., writes:

Does anybody know of a way to prevent noise in injector? In large engines with injectors Nos. 9 or 10½ the injector is conspicuous by its noise, making it impossible to understand signals passed over the boiler. A.—No remedy has been found for this noise.

(14) E. C. N., Eaton, O., writes:

Please say what proportion the steam port area should bear to the piston area of a locomotive, for a piston speed of 600 feet a minute, in order to have a practically free exhaust. A.—The area of steam port has been based on one-tenth of the piston area for a piston speed of 600 feet per minute, according to D. K. Clark's "Railway Machinery." This ratio is very generally used, as may be seen by a reference to port sizes of our modern engines.

(15) W. H. H., Dennison, O., writes:

On engines of late design I notice where cast driving boxes are used, the brass only comes to the pulling point, and is then slotted from lower end of brass, to in some cases one-half inch above pulling point. When asking for information here, they tell me that scientific men say that it is the way to put them up. What is the reason? A.—We are aware of the fact that driving-box brasses are sometimes eased at the sides in the manner you describe, and worse, but have never heard a good reason for the practice. There are good reasons on the other hand, which should condemn it, among which is the reduction of wearing surface at a point where it is most needed to resist the traction effort of the brass against the journal. The practice does not meet with favor among mechanics who believe, from long experience, that the brass should be a fit down to the center of the journal, and slightly tighter at the sides than in the crown. See our December issue of 1897 for some further points on this subject.

(16) F. A., Marysborough, Queensland, Australia, writes:

1. If a reversing arm gets lengthened from its original length, would it affect the travel of the valve, and in what way? A.—An increase in length of the lower reverse arm which supports the link would give the valve an increased travel, provided there was space enough between the ends of link block and ends of link slot to allow the center of lower rocker-pin, or what is the same thing, the center of the link block to pass outside of the line of centers of the eccentric rod pins. This is a condition, however, that seldom or never is found in locomotive practice, for the reason that a link is usually designed so as to leave barely room for clearance between in the slot, for the maximum slip of the block—⅜ inch at these points is a liberal clearance in general, and it is oftener less than more. From this it appears that the travel would not be greatly disturbed with a lengthening of the arm. 2. After an engine has been set up on her springs, with her slide valve properly set, and she goes down either front or back, what effect would it have on the valves? A.—That depends entirely on how much the engine settles on her springs. With ordinary spring deflection it will be difficult to note any distortion in the valve motion. 3. Can valves be set correctly without coupling up connecting rods? A.—No.

(17) A. K., St. Paul, Minn., writes:

1. Please explain how a pump is able to "suck" water out of wells or mines several thousand feet deep, when the pressure of the atmosphere at sea level will only raise water 33 feet. I suppose the pump is located near the water level, and so is able to lift the water out of a deep mine; but I personally know of a well 68 feet deep, where the pump is located on the top of the ground, and it seems to have no trouble to catch the water and pump it into a tank 100 feet up in the air. How is this accomplished? A.—Deep well pumping is done by means of double-acting force pumps located on the surface of the ground, and having the cylinder placed at the water supply. This was undoubtedly the arrangement of the pump you mention. In deep mine pumping, the pumps are placed in series at different levels, and pump from one level to the next higher, and so on indefinitely for any depth. 2.—In the January number you speak of an engineer who had an accident through a lap order; will you please explain what that means? A.—A lap order, in railroad parlance, is a train order which is impossible of execution on a single track by two opposing engines, without colliding. 3. Why would it not be a good idea to locate wash-out plugs on top of the boiler shell, so that water could be forced down and wash the flues, which it is not even attempted to reach with the wash-out plugs in their present position? A.—Wash plugs and hand holes are so placed on some roads, with very satisfactory results, notably the Wabash.

(18) S. J. H., Farnham, Que., writes: asking us to publish a recipe for preparing blueprint paper. A.—There is a great difference in the proportions of the chemicals used in the preparation of blue process paper, but those named below have stood the test of years, and give as bright, clean prints as any. They are as follows: 2½ ounces of citrate of iron and ammonium are put in an opaque, large-mouthed bottle containing 10 ounces of clean water. One and a quarter ounces of red prussiate of potash, finely pulverized in a mortar so as to quickly dissolve, are also put in a similar vessel containing the same quantity of water, and both solutions left until their contents are dissolved, then they are poured into one vessel and mixed, when they are ready for use. The solution is applied to the paper by tacking the latter up on a smooth vertical surface. A deep, open dish is the most convenient way to handle the solution, which should be applied to the paper with a camel-hair brush, 5 or 6 inches wide. An even application is obtained by covering the paper first with either vertical or horizontal strokes of the brush until the surface is wholly covered, and then reversing the direction of the strokes until all appearance of streaks has vanished. The paper should dry in the dark. The streaky effect will sometimes show on the paper after the print is made, even when the solution has been applied with care; therefore good prints require attention in the preparation of the paper. All operations of preparing the chemicals and getting the paper ready for printing may be done in a weak light; but chemicals and paper, after being made ready for use, should be kept from the light as much as possible, for they are both sensitive and easily injured by exposure.

Name Sounded Right.

A good story is told on Mr. Burt, president of the Union Pacific. While at Hastings he left his car and walked some distance along the track with his hands in his pockets. At length he met a section hand whose brogue told of his nationality.

"How do you like the new president?" inquired Mr. Burt, aware that the section hand did not know him from Adam.

"He's all right," replied Pat; "I niver knew av a man named Burke yet but phwat was a foine gintleman."

Amusing mistakes sometimes occur from the lack of fully appreciating a drawing or engraving. One of these happened to a friend of ours who was showing the advantages of a new axle-box whose great merit was in keeping the dust out and the oil in. A section of the box was cut away in the engraving to show how well the oil was kept in. The listener thought it was a fine thing, and then innocently asked if it wouldn't be better "without any hole" in it.

The Delaware & Hudson Canal people are building, in their shops at Green Island, a locomotive adapted for burning either bituminous or anthracite coal. The Delaware & Hudson, being an anthracite coal carrying road, has hitherto used that kind of fuel exclusively in their locomotives.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

The "Semaphore" Air Gage.

A patent for an improved pressure gage, for air-brake practice, has recently been granted to F. M. Nellis and S. D. Hutchins.

The improvement in this gage consists of a better arrangement of numerals on the dial, and the form of the glass face. The mechanism, with slight modification, is the same as that of other gages of the well-known Bourdon tube type.

Reference to Figs. 1 and 2 in the illustrations will show, by comparison, the superiority of this improved gage over the old form for air-brake practice. Fig. 1 illustrates the form of gage almost wholly used. The numerals are zero to 160, inclusive. These divisions occupy less than three-fourths of the entire circle. Again, very little use exists for those numerals below 40 and those above 120. They are so secondary in importance to the numerals which register the real working pressures, that we could, without any inconvenience to the engineer, do away with them. Here is over half the circle either wasted or uselessly employed, and the most important divisions and numerals are crowded into such a small space that an engineer cannot tell accurately whether he is reducing 1 or 3 pounds. A pound too little, or a pound too much, in making the initial reduction to take up the slack in a freight train, varies the degree of braking force obtained sufficient to cause destructive shocks to lading and equipment.

In Fig. 2 advantage has been taken of the entire circle to make the divisions as large as possible. Further, the numerals which register abnormally low and abnormally high pressures have been neglected; yet they are left on the dial in case they may be needed. This has been accomplished by causing the pointers to make more than one complete revolution. In fact, two revolutions can be made. The stop pin is inside of the gage, and only stops the hands at zero. Both pointers start at zero in the outer circle, and continue around together until 70 is reached. Then the train line pointer stops as in the ordinary gage, and the main reservoir pointer goes on around to 90, the standard main reservoir pressure; but will go higher if more pressure is carried. Notice the relative position of the two pointers. They are at right angles, and as the divisions between numerals are nearly four times as great as those on the ordinary gage, Fig. 1. Any variation from these pressures will be noticed much more quickly than with the ordinary gage.

It may be brought up as an objection to the improved gage, that the two sets of numerals might confuse an engineer—that he would not know, for instance, whether the main reservoir pointer was registering 90 pounds or 10 pounds. If the objector stops to think, he will know that the main reservoir hand could not register 10 and the train line hand register 70 pounds. Similarly for all other positions. The large-size numerals are the only ones with which the engineer is concerned.

The best and most important feature of the improvement remains yet to be pointed out, viz.: All train braking is really done between 70 and 50 pounds. The pointer, at 70, indicates maximum train-pipe pressure. At 50, it shows that brakes are fully applied, and that any further reduction is purely a waste of pressure. All work is therefore done in one quadrant, and is marked by the position of the pointer, similarly as the semaphore signal communicates with the engineer, who, becoming accustomed to gage, will brake from position of pointer rather than depend upon the numerals. As a test of this principle, an engineer ran for months with a "semaphore" gage, on whose dial were only the three numerals, 50, 70 and 90. He was loud in praise of the new principle.

Fig. 3 is almost a side view of the improved gage. The convex, or watch crystal shaped glass, without any rim, makes the position of the hands plainly visible even in this position. The face is black enamel. The train line pointer is white, and the main reservoir hand is red. This, as engineers know, and prefer, is a much better combination than the polished face. The large opening in the middle of the dial has been closed. All lettering, except the word "Semaphore," the name given the new gage, has been stricken from the dial, thus bringing into greater prominence the movement and position of the pointers. The train line pointer lies nearest to the dial, which is the reverse in the ordinary gage.

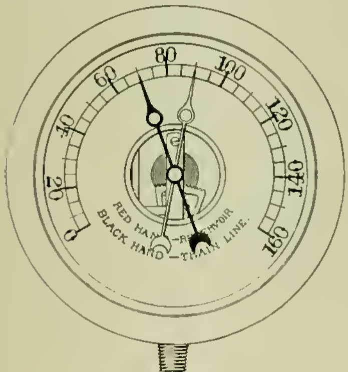


Fig. 1.

Fig. 2.

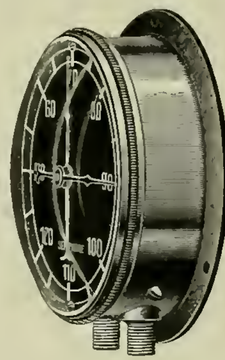


Fig. 3.

COMPARISON OF THE ORDINARY FORM OF AIR GAGE AND THE IMPROVED "SEMAPHORE" TYPE, SHOWING SUPERIORITY OF THE LATTER IN TRAIN BRAKING.

Air gages, as ordinarily furnished by the manufacturers, are merely instruments for recording pressures carried. They are identical with steam gages, except that they have two hands and two mechanisms. A gage for air-brake service must be something more than a mere pressure-recording instrument. It must plainly show small reductions, on which smooth train handling so much depends, and must communicate accurately, quickly and clearly to the engineer the state of his pressures.

Correspondents will please write on one side of the paper only. Write clearly and concisely. Use enough words to make yourself understood, but no more. Too many and too few words are equally objectionable.

Radley Automatic Opening Angle Cock and Hose Coupling.

Editors:

I am sending you enclosed photographs of the Radley automatic hose coupling which has been experimented with and ordered for a portion of the passenger equipment of this road. The photographs give a very good idea of the principle and construction of the coupling.

In this device the ordinary angle valve has been replaced by a rotary valve located in the coupling itself. On one side of the handle, which is attached to the rotary, is the segment of a gear, which engages with a similar segment on the outer flange of the opposite coupling, so that when the hose is coupled or uncoupled by hand the valves are opened and closed automatically, making it impossible to forget to cut in the air when picking up cars or coupling on a train. If the hose is coupled at all the air must be cut in. This would eliminate the danger of not having the air cut in, a cause to which many accidents have been attributed.

At a glance we might think that if a train broke in two, the valves would close; but in order to move the valve, the coupling must rotate, the same as when coupling or uncoupling by hand. So if a train should break in two they would pull straight apart, just like any other coupling, leaving the valves open. We have made repeated tests to determine this point, and find it impossible for the valves to be closed in that way.

The couplings are interchangeable with standard couplings now in use, and when so coupled the rotary valves are opened or closed by hand as they take the place of the angle valve.

Mr. Alton Radley, of Two Harbors, Minn., a conductor on the D. & I. R. R. R., and the inventor and patentee, makes some very strong and interesting claims for the device, which are too numerous to mention here. So I will leave it for him to communicate with interested parties.

D. P. Kellogg,
Asst. Gen. Foreman, D. & I. R. R. R.
Two Harbors, Minn.

VIEW OF RADLEY'S AUTOMATIC OPENING ANGLE COCK AND HOSE COUPLING COUPLED UP.

The Proper Test for an Engineer to Make for Train-Line Leaks.

Editors:

About eight out of ten men, when asked the proper way to tell whether a train line is tight, will reply, "When charged up, lap your valve, and as the main reservoir is now separated from the train line, the black gage hand will gradually fall if there are any train line leaks." This is true, but is not the best way, as can be shown by every day practice.

The train tips over the summit of a hill, and the engineer makes his first reduction and puts his handle on lap. He then makes the observation, "Well, that's queer." He will say, "the train line is leaking now that I want it tight, while standing still in the yard it was all right."

Without any further thought on the subject, this appears a matter of mystery that the train, as he puts it, leaks while running, but not while standing. When asked how he tried for leaks in the yard he replies that he lapped the valve and watched the black hand.

Right there is where he made his mistake.

If we want to see if our train line leaks, we should, after the train has become fully charged, make a five pound reduction, place the handle on lap and watch the black hand. If we simply lap the valve without applying the brakes, the triples are all in release position, and the triple feed grooves connect the train line with the auxiliaries. Whatever leak we have in the train line, it being connected with the auxiliaries, must at the same time reduce the pressure in the auxiliaries through the triple feed grooves before the black hand will fall.

We all know that with a small leak on three or four cars we cannot get along well after the brakes are once applied, while the same leak will not be noticed if these same four cars are cut in with fifteen or twenty more that are tight. This is because in adding more cars we are given a greater volume of air on the train line, and the reduction, with the same leak, is correspondingly slow, so that, with a given leak, as the number of cars is increased, the brakes, after being once applied will creep on slower.

Suppose we are testing a twenty-car train, and the cars are equipped with 10 x 24 inch auxiliaries. Such an auxiliary will hold approximately 1,850 cubic inches of air, and the train line on a 33 ft. freight car holds about 486 cubic inches. We see that the auxiliary holds about 3.8 times as much air as the train line on one car. We see then that if we simply lap our valve to try for leaks, and leave the feed grooves open, we have a large volume of air which must be reduced before the gage will register any reduction. With a 20-car train we would have 20 x 3.8, or the volume of air on the train line of 76 cars. This, added to the 20 car lengths of pipe, makes 96, that is, if we try for leaks on a 20-car train by simply lapping the valve so that, if we set the brakes before lapping the valve, the leak has to reduce the pressure on only twenty car lengths of pipe. But without applying the brakes before lapping the valve, the leak has to practically make a reduction on a train line of ninety-six cars before the gage registers the amount lost.

We should always then apply our brakes and lap the valve to ascertain the true condition of the train line in making a test, or before ascending a grade.

R. H. Blackall.
A. B. Inspector, D. & H. C. Co.
Oneonta, N. Y.

VIEW SHOWING RADLEY'S AUTOMATIC OPENING ANGLE COCK AND HOSE COUPLING UNCOUPLED.

Change in Chairmanship.

On account of pressure of the duties of his office, Mr. J. R. Alexander has petitioned to be relieved of the chairmanship of the Air-Brake Men's committee appointed to report on "The Engine Truck Brake as an Aid in Train Stopping." Mr. H. A. Wahlert has consented to relieve Mr. Alexander, and requests that members of the committee correspond with him at once, sending in such material as they may have at hand, as time is now too short to issue a regular circular letter of inquiry. This committee will have to get a stupendous hustle on itself.

Graham's Equalizer.

Editors:

I send you a drawing of my brake equalizer, to explain how it looks with the brakes hung either inside or outside.

A is the equalizer, fulcrumed on axle-box. *B* is where the equalizer is held to the wheel-piece. *C*, the brake-hanger, is fastened to the equalizer. *D*, pin on truck equalizer to allow brake equalizer to rock.

As the springs go down, due to the

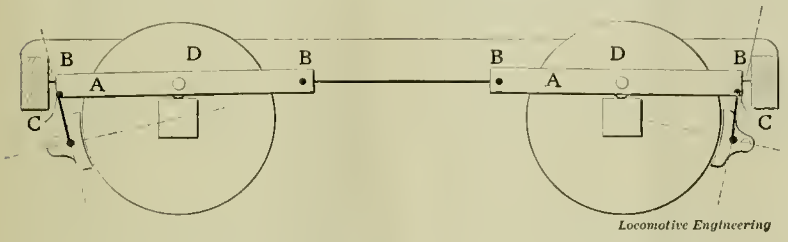


Fig. 1. GRAHAM'S EQUALIZER APPLIED TO OUTSIDE HUNG BRAKE.

load, they carry the wheel-pieces down with them, and this results in the ends of the brake equalizer, fastened to the wheel-piece, going down also. The other end of the equalizer, being free, must of necessity go up, and it carries the brake shoes up with it.

In Fig. 1, when the power is applied to the shoe, the tendency of the front wheel is to force the shoe down; but this is impossible, as the pull of the wheel downward is carried to the brake equalizer over the axle box to the truck frame, so that there is a perfect equalization of forces at the wheel downward and at the truck frame upward. This prevents any downward tilt of the truck frame in front.

At the rear end the wheel lifts the shoe up. This thrust is carried to the equalizer over the axle-box to the truck frame, giving an equalization of forces at the brake shoe upward and at the inner end of the equalizer downward. This prevents any upward tilt of the rear end of the truck frame.

By suspending the brake beams from the inner ends of the equalizer and fastening the outer ends of the truck frames as in Fig. 2, you have an ideal inside suspension, without any tilting of the truck frame. This equalizer has been in successful operation now for over two years, and has demonstrated its ability to overcome all the serious defects of the present inside and outside brakes, and to increase the brake efficiency with a decreased leverage, as the shoe is higher up on the wheel when the car is loaded than when it is empty.

J. E. Graham.

Boston, Mass.

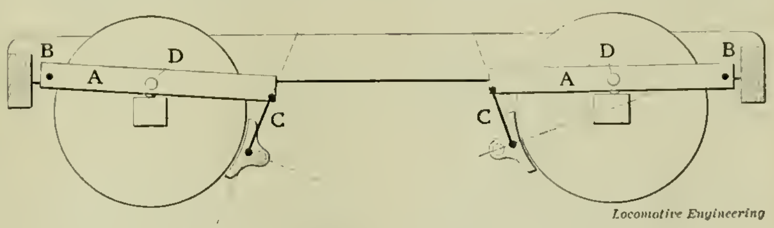


Fig. 2. GRAHAM'S EQUALIZER AS APPLIED TO INSIDE HUNG BRAKE.

A Leaky Graduating Valve.

Editors:

I support Mr. Kenyon in his reply regarding a leaky graduating valve in December number.

I do not see what would stop the slide valve, once it started to move towards release position, as train line would be the strongest pressure after the leakage from auxiliary into brake cylinder. This applies on light reduction but not on a full one, for Conger's instruction book says that a leaky graduating valve will let brake off on light reduction, but not with a full one.

I see it in this light, and would like to know if my view is a correct one.

B. W. S.,
Fireman.

Battle Creek, Mich.

[On account of the several controlling conditions surrounding the case, it is impossible to make a general statement as to whether a triple having a leaky graduating valve will or will not release the brake. If the packing ring in triple piston does not leak, the tendency for the triple to go to release is greater than if pressure leaks by. Especially is this true if a considerable length of train pipe is had. If the slide valve face and seat are perfectly air tight, no pressure will pass from the auxiliary reservoir to brake cylinder from the time the graduating port in slide valve breaks connection with the cylinder port. Before the cavity in the face of the slide valve connects the brake cylinder port with the atmosphere, a bridge or lap space of about 3-32 inch must be traversed. If the piston and slide valve moves freely and smoothly in response to differential pressures, these parts will stop on the bridge or lap space immediately after connection is broken between the graduating port in slide valve and cylinder port. However, should the friction between the packing ring and cylinder and slide valve face and seat, from any cause, be sufficiently great to destroy the sensibility of the triple piston to small differential pressures, such that it would go in jerks instead of smoothly, then the jerk is liable to land the parts almost anywhere from 1-32 inch to a greater amount, according to the degree of friction existing. In point of fact, it seems that the cause of the brake releasing shifts from the leaky graduating valve to the degree of friction existing between the parts necessary to cause a big enough jerk to jump over the bridge or lap space. If the working surfaces are comparatively frictionless and well lubricated, the jerk should be very small or nil. If the friction be great the jerk will be great. To go to an extreme, the friction might be sufficiently great to cause the parts to hang in release position until four or five pounds train-pipe pressure had been reduced, then jerk into emergency position; or, in a less aggravated case, the parts might go to service position, and hang until the auxiliary had reduced two or three pounds under train-pipe pressure, then break loose and jerk into release position every time the brake is applied. —Ed.]

Doubtful—Hardly One Chance in Many Thousands.

A Seymour, Ind., correspondent writes us as follows: "In the final summing up of your answer to question (157) in December issue, in air brake questions you scout the first cause, lean toward the second quite strongly, and to the third more strongly still. Will say that first cause was correct one. Train line hose coupling on rear end of second car on coming uncoupled swerved up and caught between sill of car and train line pipe cramping hose and shutting off flow of air from train line. On getting the stated distance from train hose jarred loose and brake went on in emergency.

"We have had two instances lately where trains have broken in two and brakes on forward section of train failed to set, and upon examination in each case found hose caught in such a position as to cramp it, thereby shutting off flow of air from train pipe."

Device for Lifting Air Pumps.

Editors:

The accompanying sketch is a simple but handy device for handling air pumps. It was designed and has been used at this place by Louis Kistler, master mechanic of the D., L. & W. R. R. at Syracuse, N. Y., for the last eight years.

By unscrewing the reversing valve cap, and screwing the device in its place, we have a safe hold on the center of the pump, and with a small pulley-block the pump can be handled with ease. The bottom of the appliance is made like a reversing valve cap, with a ¾-inch hole in the center, so as not to disturb the reversing valve stem. The ring on the top is made of ¾-inch round iron, with 2-inch center.

C. A. Woodcock,
V.-P. Lackawanna A. B. Club.
Syracuse, N. Y.

Location for Main Reservoirs.

Editors:

I see in your October number a suggestion by M. T. Jukes for location of main reservoir, in which he advocates the placing of it on the pilot in front of the front end. This location would not do on the Santa Fé, where the front end takes up all the room. But I believe there is a place for it beside the back end of the tank, where ours are put.

Now, my idea would be to put them on top of the boiler, in front of the steam dome, and as near as possible strictly over the air pumps. I have spoken to several master mechanics about this location, but they all say it "would look bad." I don't think it would look bad after we had them there thirty days or so, and had become accustomed to it.

If main reservoirs were placed on top of the boiler, with a drain cock in the pipe leading from the pump, in lowest place, and another in throttle pipe at connection to pump, I believe that air freezing up would be a thing of the past.

I have seen as high as fifteen engines at one division point standing out doors ready to go out, and every air pump working hard enough to supply thirty cars in order to keep the air from freezing up, the stop cock on back end of tank wide open and no cushion for pump.

Now, I don't see why an air-pump is worked to keep the air from freezing, and I don't believe it necessary.

A. L. Beardsley,
A., T. & S. F. Ry.
Chanute, Kan.

[Air will not freeze. That which is commonly called air freezing is in reality the moisture in the air which collects in a "pocket" or "dip" in the pipes, and freezes. Straight pipes, slightly inclined, without places for moisture to collect, and drain cocks in necessary places will do away with this trouble.

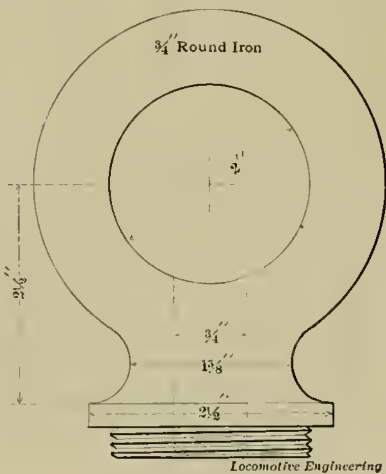
The practice referred to is not considered a good one.—Ed.]

Locked Driving Wheels.

Editors:

Relative to your answer to question 130, November number, would like to say: I realize it bad practice to have driver brakes adjusted to skid wheels. However, they will sometimes do this. The case happened with me several times with an engine recently out of shop—a twelve-wheeler, all drivers braked (8), her tires turned up and new brake shoes all around.

Each time they were locked, I started them revolving by jumping the throttle open. This is quite different from starting an engine, from a stand, with driver brakes set, for in the first instance you have the friction between the wheels and rail in your favor; while in the second case you simply have the pressure on pistons.



DEVICE FOR LIFTING AIR PUMPS.

Yours very truly,

W. B. Van Horn.
Wadsworth, Nev.

[We do not believe the practice of jumping the throttle open to start the drivers revolving when they are skidding is one to be relied upon. Our experience is that it will fail a great many more times than it will succeed. There is very little adhesion between the rail and wheel when wheels are locked.—Ed.]

An Announcement.

We are requested to announce that all business communications to the Press and Printing Committee, and the Committee on Arrangements for the fifth annual convention of the Air-Brake Association, to be held in Baltimore, Md., the second Tuesday in April, be addressed to S. D. Hutchins, 1207 Havemeyer Building, New York city.

Jake Baker Takes His Second Degree in the Air-Brake Association Club.

Mester Yeditor:

You vill bleas eggcuse me ef I vas madt ligk some hornedts, und use som verds ligke a pirade, budt I hef peen in som touds ef I vas or vas nodt. Jake Bagker ef nodt. Vy is der reason uf idt? Dis is vy I gidt me dwisted oop mit myselfs. Veek before negxt I toogk mi segond tegre in der Are Bragk Essociashun Club.

Mi frendt Lum vas dere, al trest oop mit er silgk hat on hese hed, undt er voise so solum ligke dot I fele der cole schils run mi bagk oop. Ven he cals der meading to ordter, undt dese vordts he sed efter he hed repeaded som sines. Dis lotge is now deglared tuly opben in der segond tegre. You vill nodifi yoreselfs acgordingkly. Ven he strigked der dop ef der tesk a coople uf reps mit er bease uf are hoase. "My Brodthers," he saidt, "ve hef mitoudt a ferst tegre memper. He vishes tu pe edvenct to der segondt mile bost, uf der is no ubgeckshuns ve vill broceed."

Efter vatingk a vile, he sedt, "Master Sendenel, you vill bresend der candertate in der usul form." Der sendenel sed, "Jake, dismandle. In blain vords, dake of dose hend-me-towns." I sed I didn't ligke dis so brevious, budt mi frendt Lum Miller he dels me idt vas al ridt. Efter I hadt pudt on a pran new segondt hend pare uf penaloons, mit plue stribes oop, und der legke cut py der nees of (say, dis vas der vorst case uf fits I effer hedt), a bell gord aroundt my vast dwice, und er are hoase in mi ridte hend, undt er dummy in der lefdt. I vas alzo hootvinkt so dot mi frendts wooldnt regocnize me. I vas condugted to der toor, undt gif de alarem, ven som von insite schweal oudt:

"Vats de cose uf al dis ubrore undt tisdurbence? Vats yore name?"

I sed idt vas der same Jake Bagker ho vas hear vonce pefore ven I gidt mi ferst tegree.

He saidt, "How ma I no you hef any tegree?" I saidt, "Py som vords undt sines." He saidt, "Give me som vords." I den visper in hese ere, W. A. B. in too silables. I vas ten temanted to magke som sines. Efter dis I vas valket on a run dwice aboudt der room, undt lest budt nodt leasd oop agin der vall ger-plunk. Dis vas to ilustrade to me a colishun uf bodt ends uf der drains ven dey bragke indoo in der are, or dem emergency stobps at vater tanks. Dis vas so imbressive dot I vas opliged to sidt town undt resdt vile I shedt sum teres.

Aboudt dis time der Chudge saidt, "Jake Bagker, you dink you vas madte a segondt tegree memper alredty, budt you vas misdaken. Pudt oudt yore ridte hendt. Now, mi frendt, vat vas derfoundtashun sthone uf Liberdy, Egwalidy undt Brodecshun?"

I saidt, ven I sphoke, "Dose Are Bradgkes."

Hes enser vas, "Dis vas goodt. You vill now be conduchted to der cender uf der roome, undt dere causd to neal. Yore ridte hend resding on er copy uf 1897 Broceedings uf dose Are Bragke Associashun. Yore lefdt hend in en upride bosidishun inglined aboudt 97 tegrees."

Ven I vas broperly blaced, der Chudge hidt me dwice on der hed mit er hoase cooplingk, undt gries oudt, "Ven he vas alife he vas goot to der poor. Ven he vas teadt ve fergidt hes falts. Broders, vat vas der grate medium dot leeds to charity undt benevilense?"

Den eferpody schumps to dere feadt undt gries oudt, "Money!"

Dis meen som moor uf mi vages, vich vas tuly reseift, ven dere Chudge repeadt dese vords, in sooch a voise dot soundt ligke a grosscut saw mit two dagoes undt a railroadt tie mit sphikes in idt.

"Mi frendt, wat fer shell we lif? Vat fer de soon, moone und sthares schine frum de skie? Ah! mi frendt, mit de hare ligke silver; you ho hes peen grawling oop de roof uf lifes vat vas godt ofer on de uder sidte, undt is holdtingk pack hardt to geep from schliping oof, you does dot lifes ligke limberger schese, al madte oop mit sthreaks uf tark undt lidte, vich is somdimes goote, undt somdimes bad. You hes peen scheadedt undt humpugdt undt sendt aroundt der rong gorner undil you dink life ese goote fer nodingks frum der money vat it gosts; pudt pefore you ken go on midt dese serimony idt vill pe necessery fer you to magke som bledges to geep der pease."

Den der Chudge saidt, "You vill repeadt after me: 'I Jake Bagker, do vilingly. mitoudt hesidashun, magke dis mi efetdafit dot I vill respegt der brominence uf dese associashun. undt er-bide py der magoridy vote so long vat idt don't indefere mit mi bolidical siduashuns.

" 'I also bromist to brodect mi vorthy brodthers family so long vat I could mitoudt ingury to miselfe. Dot I vould lone dem money on ferst mortgage on dere broperdy undt tagke dere inshurance bolicy as seguridy. Dot I vould alvays helb miselfe ferst undt den mi brodthers pefore helbing som one else.

" 'I also schwear dot I vouldt nodt exphose enyding vat vas don mit me vile goufering dese tegrees efen do dey midte kil me.' " Aboudt dis dime som van sthruck me in der negk. Vat hepend efter dis I no nodingk. Ven I vake oop I vas findt miselfe in ped py mi home undt mi vife grying en sayin vat a nice dingk dot he hef som inshurense py hes life.

Now, Mester Yediter, uf dis vas som vay to gidt inshurense py mi life, so dot mi vife vill hef som morningk glose, undt by me von grafestone mit er lam on dop, I vill go me oudt uf bolidicks ridte avay.

Yores in doudts,

JAKE BAKER.

Elmira, N. Y.

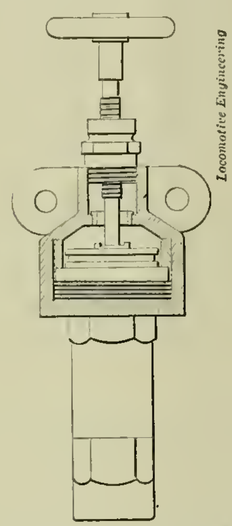
Doc's Object Lesson.

BY CLINTON B. CONGER.

"Doc" writes me that he has learned a whole lot of things about the way the air brake works. He says:

"My son-in-law, Brown, and I went hunting squirrels a few weeks ago, about thirty miles from Indianapolis. We went out very early in the morning and got back to the road in the afternoon, just as the local freight came along. Old, quiet Jones was on the engine. He got the name of 'quiet' because he talked so low; but he makes up in speed of jaw what he lacks in noise.

"When he stopped at the station, Brown and I got on the engine. You ought to see him handle the brake. Every time he wanted to steady up the train to make a coupling or spot a peddler, she went on full force; and after the train had fetched up with a jerk, he would let it all off again. Why, he set her full on and let it off five times in just backing into a siding with a string of cars. When he got in where he wanted to stop he smashed the brake on; she didn't stop, so he pulled her clear in ahead. I wonder that the drawheads didn't pull out; but they make them pretty strong nowadays.



R. E. STATE'S JACK FOR REMOVING FEED ATTACHMENT PARTS.

"He got to kicking about his brake valve; said that it didn't carry excess right Sometimes he would have 40 pounds, other times not any, and when he didn't have any excess the pump would stop, and driver brake set so tight he thought he would stall.

"Says Jones to me, 'Just look here, I will let off the brake now and you see.' When he did the black hand went up to 85 pounds and the red one dropped to that pretty quick. The brake began to set and the pump was stopped.

" 'Now,' says Jones, 'When we have a train it is just the other way, 100 pounds on the red hand and not over 50 or 60 on the black one. That new air brake repair man don't know much about keeping valves in repair for us.'

"Brown says to me, 'Let's go back to the way car. There is more room there.' So we went back. Says I, 'That's the trouble with the braking on this road. They never have the brake valves in order so a man can tell what to expect that it will do.' Brown laughed a little and said,

" 'Father Troy, that is just where you will get left.'

" 'How is that,' says I.

" 'Well,' says Brown, 'you see him put his brake valve in full release and leave it there till the train line charged up to 85 pounds, and the red hand dropped down from 100 to that. Then he put his valve in running position and expected the gage to show excess right off. The train pipe was 85 and the governor, which is connected to it with a D-8 valve, was set at 70, so the pump stopped and stood still till the train pipe went back to 70. As there are lots of leaks on his engine it did not take the brake long to set. Now, when he has a train, it takes so much air to charge up the train pipe, he never gets up to 70 on the black hand. Very likely he uses so much oil in his air pump that the excess valve is choked up so the air wont go past it fast enough to fully supply a train, when of course the red hand will raise. I can take the best D-8 valve on the road and make it act the same way.'

"When we got in the car we laid our guns down on the side benches and made ourselves comfortable.

"The conductor saw our guns and game bags laying there and says, 'Mr. Troy, you had better put your guns where they won't get broke. Old Jones makes some fly stops and tears the whole inside of the car to pieces.' So he put them in the lockers.

"The very first stop we made I thought we were off the track, or had a head-ender. I looked across at Brown, but he was hanging on and looking the other way. The conductor says:

" 'How is that for a smooth stop, Mr. Troy?'

" 'That is awful,' said I.

" 'Well,' says he, 'that is about the way he does it all the time. Sets it hard all at once without waiting for the slack to run up against the engine. Just wait a minute and feel him let her off.'

"Sure enough, in about a minute we got a jerk the other way that nearly threw us all out the back end.

" 'We darsent cut in very many air cars behind him to use. How will he make out next January, when the law requires all the trains to be handled with the air brake. Would you like to ride behind him?' says he.

" 'Well, not much,' said I. 'Is he that way all the time?'

" 'Oh, no,' says he, 'sometimes he is worse! This is mild!'

"Brown never said a word, but he looked

kind of off outdoors, like he does when he has a specially hot one laid up for me, so says I:

"'What do you think about it?'

"Says he: 'Father Troy, that is just the kind of work you used to do, and you made a great fuss when they called you up on the carpet about it. Now, Mr. Jones has an idea that he knows all about the air brake; but you see how much good it does the company.'

"'Yes,' says I, 'that makes me think that when I was pulled off, Jones came around and told me to come out with him a few trips, and he would show me all about it.'

"Brown says: 'It would have been the best thing in the world for you; it would have been an object-lesson in poor braking, to have thrown you around the way-car a few times, and have you find out that was just the kind of braking you were doing. Now you go over on the engine's next stop and watch him handle the air, and see if he don't make a good job of it according to your practice. I have fired for him, and know just what he will do. You will see him make about a 3 or 4 pound reduction, and when he don't feel the brake take hold solid, before the slack can run in clear from the way-car, he will take off 8 or 10 pounds more. This will anchor the head end good and solid for the rear end to run up against, and the way car feels it sure. Then when the train slows down too much, he will let the brake off, and as soon as he lets go of the brake valve handle, he will grab the throttle and pull out before the slack has a chance to run out easy; that will jerk the hind end of the train just as you have felt it.'

"I went over ahead and rode with Jones: it was just as Brown said. I says to myself, 'That is just the way I used to do.' You can bet I did some heavy thinking about it till we got in. Brown tells me that some of the men that learned to handle the air when we had straight air, and afterward with the plain triple valves, think they are right in line for good work with quick-action triples; but they ain't. I suppose the reason I never run up against these facts before is because I never got in a way-car with a poor air-brake man handling the train. If some more of the fellows that shake things up had to ride on the hind end, and see how it goes, maybe they would pay attention to doing smooth work."

"Doc's" object-lesson will do him good, and if an engineer who is complained of for rough work with the brake had to ride behind while someone was copying his style of work, one lesson would cure him.

I believe that every engineman takes enough pride in doing good work, and when it is proved to him that he does not, a change will come just as soon as he can learn how.

Handling Sixty Cars of Air.

That sounds easy, but how many of your readers have ever tried it?

Having had not a few inquiring letters as to how we do it, I thought it might be interesting to many of your readers to know how freight trains of more than the standard fifty cars can be successfully handled.

At the outset, I will state that considerably more than half of all our freight trains are "double-headed." Where two engines are placed together, the first rule that must be observed is, that the smaller cylinder, and consequently the lighter-framed engine, must be placed ahead. When there is little or no difference in that respect, then the engine having the larger air pump may precede. There is yet another governing matter, where all locomotives have not yet been equipped with stub pilots and short-bar or automatic couplers. The long, old-fashioned push-bar frequently breaks, and it is much preferable not to make use of it in coupling up two engines if either has a stub pilot.

Thus it will be seen that, with a few exceptions, the leading engine is apt to be a small engine, carrying a low steam pressure and having but a 6-inch or 8-inch air pump. More than this, perhaps the main reservoir is of but 16,000 to 20,000 cubic inches capacity.

The train limit of sixty cars is rarely exceeded, although we have handled sixty-five all air trains. In charging the train, both engineers are permitted to do the pumping up to 65 pounds, when the second man cuts out his valve, and the head pump compresses to 70 (so as to know that he can more than supply the leaks), and makes the terminal test of the brakes. In starting such long trains, the leading engineer takes out the slack before the second engine does any work.

Now, it has been found necessary by us to insist on several points which experience has taught us must be rigidly observed in handling sixty cars of air. First, sufficiently heavy initial reductions must be made to get all pistons past the leakage grooves; second, the brakes must not be released until after a dead stop is made where possible to do so; third, if necessary to release (especially while train is moving) a sufficient amount of excess must be on hand to release the rear cars before the head end surges ahead and breaks the train in two; fourth, that steam should not be worked until sufficient time has elapsed after releasing to prevent jerking or tearing the train in two.

Practical experiment has determined that the first reduction with a 60 car air train should not be less than ten pounds to get all pistons by their leakage grooves.

In taking water or coal no attempt should be made to spot the engines at the tank or chute, but the stop should be made short of the desired point and the engine or engines cut off.

With the D-8 valve (which is easier remembered as the 1890 valve in distinction from the D-5 or E-6 or F-6, which we term the 1892 valve) a high excess pressure does not have to be carried at all times as it is accumulated whenever the brakes are applied, while with the 1892 valve where the governor regulates the main reservoir pressure, unless the governor has a cut-out cock (which we have not found satisfactory), a high main reservoir pressure must be carried. A safe rule that applies to long trains is this:

The engineer should see that the red hand is as many pounds in excess of the black hand at the moment of release as there are air cars in his train.

Supposing the train line to be 55 after an ordinary 15-pound application has been made, then this rule would require the red hand to be at 55, plus 60, or 115 before a release should be attempted with a 60 car air train. Thus 115 would be the standard main drum pressure at which to set the governor with 1892 valve, while with the 1890 valve the engineer should wait until the pump had compressed 115 pounds in the main drum before releasing.

With long freight trains of any given number of air cars, a good rule is this: With the 1892 valve, set the pump governor so that the main drum shall have as many pounds above seventy (or the standard train line pressure) as there are air braked cars in the train, less fifteen. That is with 60 cars of air carry 60, less 15, or 45 pounds excess. With 50 cars of air carry 50, less 15, or 35 excess, etc. If the older forms of engineers' valve are used where the pump governor controls the train line pressure, see that the red hand gets to the same point as before indicated before a release is made.

In slowing up for interlocking switches, drawbridges, block signals, etc., where a release must be made while train is moving we have used two methods of holding in the slack, but with only partially good results. The one is to use retainers on the engine and tank, and the other is to have connected to the driver triple four-way cock a lever with which to cut the drivers to straight air at the moment of release.

Whether moving or standing, whether all air or part air, to be perfectly safe an engineer must wait after releasing as many seconds as he has total number of cars in his train before opening the engine throttle. For, if the train is part air, even in making dead stops, remember that the non-air cars (or scabs, as the brakemen rightfully call them) begin to run back from compression of the draw bar springs.

After patiently reading this over some bright air brake philosopher will remark: "Why don't they get all big pumps, put on larger or double main reservoirs and use double top governors and thus solve the whole problem." But suppose my good friend and critic should figure out the cost of an immediate change, not only on our more than a thousand engines, but on the thousands of small power, which other roads that are not already doing so will shortly find it advisable to double up on long all air braked trains! However, I know many of your readers who have to do efficient work with the equipment on hand until they can get better, will be interested to know how we have solved this problem—for problem it was.

When a man who has only worked it out on paper gets out on the road with a sixty car air train, "slows 'em way down" and then decides to release (with 25 pounds excess) and "crawl up to the tank," when, I say, thirty seconds later he picks himself out from the right front corner of the cab, quickly wends his way back to the rear with the coal pick to ascertain "who pulled the air from the hind end," and finds to his amazement his train is not broke-in-two, but rather broke-in-four back forty-five to fifty-five cars from the engine; when he finds all this it gives him food for reflection.

Then it is, while chaining up drawbars and answering telegrams as to why he does not get out of the way of the two stock specials and the fruit train behind him, that he wonders if there is not a slight difference between handling the air on a three-car passenger train, like Barney Cullock's, and a sixty-car freight.

He had heard Barney, but a few days before, while berating their interest in air-brake matters, tell a crowd of firemen who were collected in front of the bulletin discussing some problems of their progressive examination which they were about to pass, that he (Barney) "used her all it goin' by, and never carried no excess, neather," and in his forty-seven years' experience, "divil a mon would find him sthuck at a wather tank, that he could not back up, and that right quick."

We hope Barney won't get set back to pulling freight.

E. W. PRATT,
General Air-Brake Inspector,
C. & N. W. Ry.

Chicago, Ill.

Fifth Annual Convention of the Air-Brake Association.

At 9 o'clock A. M., Tuesday, April 12, 1898, in Baltimore, Md., the Association of Railroad Air-Brake Men will begin their fifth annual convention. The Committee on Arrangements is now selecting hotels, securing special rates for the members, their families and guests, etc. Full particulars of this convention will be announced later in these columns.

Air-Brake men should apply at once to their immediate officials for passes to the Baltimore convention. Don't put it off, and be too late.

QUESTIONS AND ANSWERS
On Air Brake Subjects.

(11) R. Q., Marshalltown, Iowa, asks: What size auxiliary should 10-inch driver-brake cylinder have equalized for six drivers? A.—12 x 33, or one that would give 50 pounds pressure in the cylinder.

(12) R. Q., Marshalltown, Iowa, asks: What will cause an auxiliary to be undercharged? A.—A feed groove too small in size or partially clogged up with dirt. Too large auxiliary reservoir. The rate of charging should be about 1 pound per second. It is possible another triple nearby may be charging too rapidly.

(13) C. P. Duluth, Minn., writes:

1. In case the lines are coupled up wrong between the engine and tender, can the brake be worked? A.—1. No. 2 How would you detect the ones that are coupled up wrong? A.—2. Follow each pipe along, and see where it leads to. Detect the wrong connections, and couple them properly.

(14) H. I. G., Cincinnati, O., writes:

I have found one governor piston No. 53 with a small hole drilled from the packing-ring groove to the inside (cored part) of the piston. Should this hole have been there? If so, what is its use? A.—The hole has been put there since the governor left the air-brake shops. Possibly it is a blow-hole in the casting. It has no use.

(15) J. B. S., Hanover, Md., asks:

Will the lubricator of the air pump feed when the pump is shut off by governor, same as when pump is running? A.—Yes, or nearly so. But if the pump is shut off a length of time sufficient to allow the steam entering from the boiler to condense and fill the steam pipe and lubricator with water, the oil will remain in the top of the lubricator.

(16) H. I. G., Cincinnati, O., asks:

For what purpose is the small hole (about 1-32 inch in diameter) through the steam valve No. 51 in the F-8 governor? A.—So that when valve No. 51 is seated, steam may pass through the small port to the pump in a sufficient quantity to keep the pump slowly moving. This prevents condensation from forming which would be thrown out over the jacket and front end, and also prevents freezing in very cold weather.

(17) H. I. G., Cincinnati, O., writes:

Why is piston No. 53 in the F-8 governor made wider than the one used in the old-style D-9? When the piston is forced down to close the steam valve, its lower edge seems to cover the hole leading to the waste pipe. A.—The wide piston acts as a guide, and both the piston and the rod therefore have less wear, and wear more evenly. The piston is sufficiently loose to permit waste steam and air to escape to the atmosphere.

(18) F. P., Montevideo, Minn., writes:

We are having considerable trouble with governors not working. Where is the trouble? Air blows out through lower port strong between steam and air valve. A.—Please state the type of the governor, and say what is the particular trouble. If it refuses to shut off the pump, we conclude from the data given that the piston packing ring is worn, and permits the pressure to leak from the top of the piston past the packing ring faster than it can enter from the diaphragm chamber.

(19) C. P., Duluth, Minn, asks:

Why is there only one line of train hose between engine and tender on some engines that have both drivers and tender brakes? A.—Engines supplying driver-brake cylinders and tender-brake cylinder from the tender auxiliary require two lines of pipe. Should the main reservoir be on the tender, however, four lines will be required if tender and driver-brake cylinders are supplied from tender auxiliary. Engines having separate auxiliaries for tender and driver require but one line of pipe if the main reservoir is on the engine. If it is on the tender, three lines will be needed.

(20) R. Q., Marshalltown, Iowa, writes:

A triple valve refuses to work only when an emergency application is made. On examination a small ridge is found to be worn by the piston halfway around the cylinder, and opposite to the ports in the slide valve seat. What causes this wear? If caused by the air pressure, would it not wear on the opposite side? A.—It is probably caused by the spring between the slide valve and piston stem having too much tension; or possibly it is due to the end of the stem entering the cap nut being bent, so as to throw the strain on the side of the cylinder mentioned. The air pressure would not cause the ridge to form.

(21) C. P., Duluth, Minn., asks:

1. What pressure should be carried on signal line? A.—1. 40 pounds. 2. How would you know if you had train-line pressure in signal line? A.—2. When brakes were released, the whistle would blow. The main-reservoir pressure is reduced in releasing and recharging, and signal line, if in communication with main reservoir, will also reduce, causing the blast of the whistle. The inspector's gage, coupled to the signal line, will also tell. 3. What would you do if signal line should break between reducing valve and main reservoir? A.—3. Use your ingenuity and means at hand to repair it. You may, and probably will, lose the use of your signal. Ofttimes a well-fitted wooden plug will suffice.

(22) B. J. E., Indianapolis, Ind., writes:

A road entering this place is changing the graduating springs in their passenger equipment, removing brass spring and inserting the phosphor bronze, in plate

F-27 and F-29 triple valves; also changing the preliminary exhaust port of the plate D-8 engineer's valve from 3-32 inch to 5-64 inch. The inspector claims that if the "ports" in the D-8 valve are not changed when the new springs are applied to the triple valve, it will cause the brakes to "stick, and possibly slide wheels." I do not understand how changing the graduating spring to the new standard and leaving the preliminary exhaust port 3-32 inch is going to "stick the brakes." A.—The inspector means that the triples may go into quick action when not desired. By reducing the size of the preliminary exhaust port, the discharge of the train-pipe pressure at the brake valve is slower, and there is less tendency for the triples to go into quick action. We do not believe, however, that the fear is sufficiently well grounded to require a change in the size of the preliminary exhaust port of the brake valve.

(23) E. L. C. and N. B., 11 Royal Terrace, E., Kingstown, Ireland, write:

On page 848, November issue, question No. 130, you state that it is nearly impossible to slide the drivers of an air-brake engine when train breaks in two. We recently saw a large ten-wheel tank engine (four coupled drivers, leading four-wheel truck and trailing radials, drivers steam braked) shunting, and twice the drivers were made to slide. The brakes were not applied hard, simply to stop engine when running at about ten miles per hour; rails were dry, and engine was not reversed. On both occasions drivers locked instantly brakes were set, and engine slid on for about twenty yards before stopping. We suppose an air brake is more powerful than steam brakes, and yet how is it that the weaker brake can apparently do what the other and stronger one cannot? A.—High braking power may be had in two ways, viz., high power and low leverage, or low power and high leverage. A heavy weight may be equally well lifted by a strong, heavy man with a short lever, or by a small, light boy with a long lever. Possibly the engine you mention had either too high a leverage or too large a cylinder. So far as pounds pressure in a driver brake cylinder is concerned, 50 pounds of steam is the same as 50 pounds of air pressure. An air brake is not necessarily stronger than a steam brake, but is more carefully designed and proportioned; hence gives maximum braking power with minimum of wheel skidding.

We are still receiving communications from readers who request that their letters shall not be published, and that the desired information be sent them by private letter. Our columns are open to all, and we cannot, therefore, attempt the immense task of answering privately that which should be answered publicly.

Distance Needed to Stop From Speed of Sixty Miles an Hour.

A correspondent recently wrote us, saying that two friends had got into a little dispute about the distance required to stop a train like the Empire State Express from a speed of 60 miles an hour. One believed that 880 feet was about the distance required, using air, sand and steam. The other did not believe the stop could be made in that distance, so we were referred to to settle the question.

We supposed that the necessary distance, under favorable conditions, was about 1,200 feet; but, to make sure, we applied to the Westinghouse Air Brake Company, and received the following information:

"A series of tests with the most approved high-speed emergency brake adopted by the Westinghouse Air Brake Company was made upon the Pennsylvania Railroad in October, 1894. The tests were made upon a train consisting of a locomotive and six passenger cars. The locomotive was fitted with engine truck brake in addition to the ordinary driving-wheel brakes, and the whole apparatus was of the high-speed type. The train-pipe pressure was 110 pounds. The stops were made upon a descending grade of 29 feet to the mile, and sand was automatically applied to the rails throughout the stops. The weather was fair, and the rails were dry. The stops made from a speed of 60 miles an hour were done in about 1,150 feet. The effect of the descending grade would be to lengthen the distance run about 50 feet, as compared with a stop made on the level. The distance therefore required in which to make a stop from a speed of 60 miles an hour may be taken as 1,100 feet.

"It is not probable that any advantage would be obtained by 'the use of steam,' by which I presume he means reversing the engine. In the use of the high-speed brake, the driver-brake power is about as great as can be employed without locking and sliding the drivers, and reversing the engine would be almost sure to result in sliding of the drivers, which would increase instead of shorten the stops. The proposition that the Empire State Express trains could be stopped upon a level from a speed of 60 miles per hour in 880 feet is entirely untenable."

About American Rails.

An interesting talk on rails was recently given to the *Commercial Advertiser*, of New York, by a well-known steel man. He said:

"The production of steel was not large until the invention of the Bessemer process in 1855. The secret of that process was the removal of the carbon, silicon, etc., from pig iron by means of a blast of air or steam through the molten metal.

"Bessemer steel was not produced in the United States until 1867. American steel rails sold for $160 a ton in that year, but by 1871 the price had fallen to $102 a ton. The steel works at Bethlehem were opened in 1873. Other steel works were opened about the same time at Cambria, Pa., and Cleveland, O. The rolling-mills at that time were very small. During the year 1873 the price of steel rails dropped to $90 a ton. The Bethlehem Company sold its product at that figure. From $90 the price fell to $75 in 1875, and to about $42 in the beginning of 1879. In the winter of 1879-80 the price advanced rapidly, until, by the summer, rails sold for $85. From 1880 to 1884, railroad construction was being pushed all over the country, and rails were imported, in immense quantities, from England, France and Germany. In 1884 the price had decreased to $62 a ton, and it continued to fall each year till 1890, when rails were sold at from $30 to $40 a ton. They are worth at the present time $18 to $19 a ton at the mills.

"In 1873, when rails were selling at about $90 a ton, one mill could produce 25,000 to 30,000 tons per year. A little later one company began to produce 50,000 tons a year. That was considered a remarkable achievement. At present some mills roll 2,000 tons of rails every twenty-four hours, employing for the purpose only one-third of the number of laborers that they would have employed twenty years ago to roll 500 tons. Some mills in the United States to-day can roll more rails in a month than any mill in the country could have rolled in a year twenty-five years ago. The fall in price is attributed to the substitution of machinery for hand labor, cheapened means of transportation and the working of mines containing a superior grade of ore. Machinery has been substituted for hand labor to a larger extent in the production of steel than in many other industries. Almost all the processes through which the ore is passed, from the time it is dug to when it emerges a finished product, are effected by machinery.

"The most important factor of all, however, in reducing the price of steel was the discovery of the Lake Superior mines. No mines in the world, it is said, produce ore of such good quality for the manufacture of steel. The supply of Lake Superior ore is practically inexhaustible. As long as it holds out England cannot compete with this country in the production of steel rails.

"The valuable iron ore deposit at Cienfuegos, on the south coast of Cuba, is owned by Americans. It is of a fine grade, and much of it has been imported to this country."

We have just received a new edition of Conger's "Air-Brake Catechism." Price 25 cents. Send for it.

Pittsburgh Locomotive Works—Intercepting and Reducing Valves for Compound Locomotives.

The standard system of compounding locomotives by the Pittsburgh Locomotive Works is illustrated herewith, in the device and essential parts used in its operation. Fig. 1 shows the saddle and cylinders, the receiver and the location of the intercepting and reducing valves on the right or high-pressure side of the engine.

Sectional views of the intercepting valve indicating its position for working the engine either simple or compound, make its functions plain. In Fig. 2 the valve is in the position it occupies when the engine is working simple; the passage to the receiver is seen to be open to the reducing valve, which is shown admitting live steam to the receiver. With the intercepting valve in this position, the high-pressure exhaust is open to the atmosphere, thus making a simple engine with independent exhausts.

In Fig. 3 the intercepting valve is in its forward position, where it is always found when the engine is working compound. The passage between the reducing valve and receiver is closed, and the exhaust from the high-pressure cylinder is diverted from the open air into the receiver, passing from the receiver to the low-pressure cylinder.

The operation of the intercepting valve to convert the engine from simple to compound, or the reverse, is entirely automatic, and is controlled by the reverse lever, as shown in Fig. 4. The means by which this result is obtained is a small steam or air reversing cylinder placed in or near the cab, the valve of this cylinder being actuated by movement of the reverse lever. When the lever is down, or at full stroke at either end, the intercepting valve is in the position shown in Fig. 2, which position allows the admission of live steam to the receiver. By moving the reverse lever one or more notches toward the center, pressure is admitted to the reversing cylinder at the cab, and the intercepting valve is moved to the position shown in Fig. 3, causing the engine to work compound. Dropping down the lever to full stroke again, changes the valve, and the engine works simple as before.

This automatic control of the intercepting valve, it is seen, makes the engine simple while starting and in need of maximum draw-bar effort. The manual control is exercised when "hooking up," which operation must be attended to in order to make the engine work compound. There is an auxiliary lever shown in connection with this arrangement, which is handled from the cab in case it is required to do so for any reason, thus leaving the control of the intercepting valve in the hands of the engineer. The reducing valve is operative only when the engine is working simple, being held shut by the intercepting valve when the engine is working compound, and is so designed as to reduce the steam from the boiler to a pressure equivalent to the ratios of the two cylinders, before delivering it to the receiver, thus equalizing the pressure on the pistons. An absence of ground joints is noted in this system, there being but two, one in the reducing valve, the other in the intercepting valve. It is also interesting to note that by shutting off steam from the reversing appliance in the cab, the engine can be used single expansion for switching and other purposes up to eight or ten miles an hour.

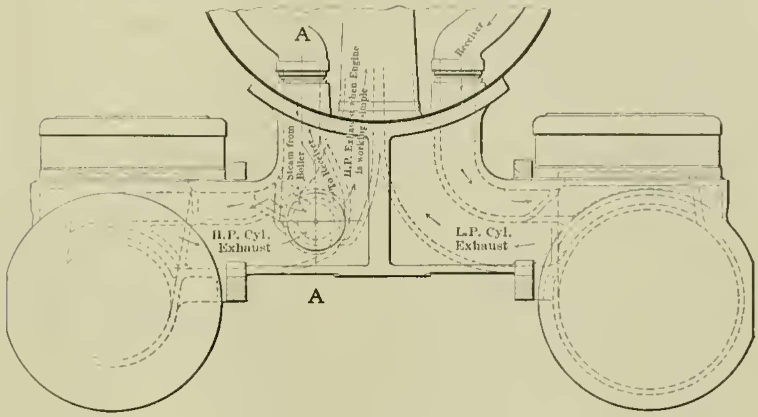
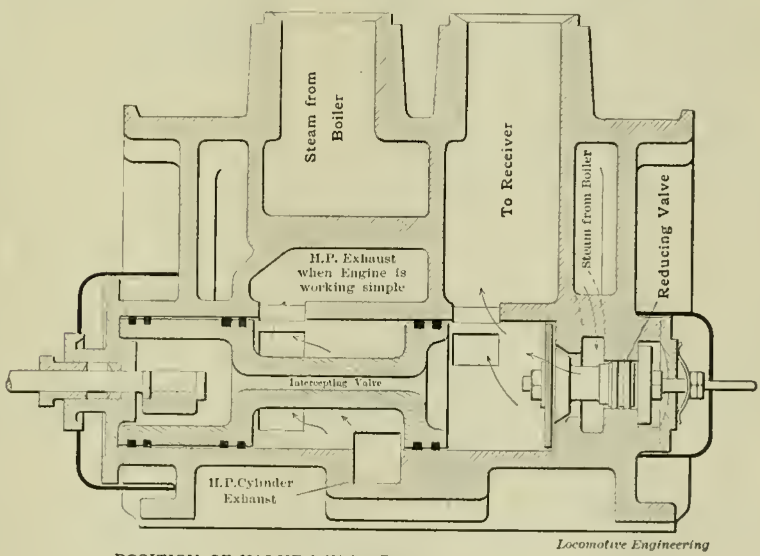


Fig. 1



POSITION OF VALVE WHEN ENGINE IS WORKING SIMPLE

Fig. 2

INTERCEPTING VALVE.

American Electric Motors for the London Underground Railway.

Among the large orders lately received at the General Electric Works in Schenectady, N. Y., is one for thirty-two electric locomotives for the Central London Underground Railway. This contract will not alone affect the General Electric Works, but the Schenectady Locomotive Works as well, for the locomotives will probably be constructed by that concern.

A generator of 4,000 horse-power and weighing 87 tons, is in course of construction by the General Electric Company for the Louisville Street Railway Company. The company has also received an order for thirty-six 175 horse-power motors from the Metropolitan West Side Elevated Road, of Chicago. The company equipped their road with electricity some time ago, and this is a second order.

The condition of the car-building trade in the United States to-day may be understood from the fact that the Duluth & Iron Range wanted to order 400 cars and the time for delivery was so protracted that they have commenced building the cars in their own shops.

Engine Springs.

In Mr. R. P. C. Sanderson's interesting arraignment of railroad fads the question of engine and truck springs came in for a share of criticism, and the use of coil springs instead of elliptical was advocated. He shows a saving of $69.12 per engine, if equipped with coil springs, as against the elliptic spring, which is probably right so far as first cost goes. But there is another side to it, and not the "ostensible reason of making the engines ride easy for the men," either.

It isn't the easy, graceful movement of a gazelle that is desired for appearance' sake or for easy riding, but for prolonging the life of the engine and its many working parts, which can, it seems, be done best by use of the expensive elliptic spring.

There have been numerous attempts to supplant the elliptic spring with the coil pattern, especially on tender trucks, but they have not been entirely successful. In fact, the Pennsylvania Railroad is now changing all tender trucks back to elliptic springs as fast as possible, and is removing the coil springs, despite their smaller first cost.

It has been found that the shock and jar to the running gear, and the attendant derangement and breakage, are so much greater with the coil than with the elliptical spring that the difference of first cost is more than offset by the cost of repairs due to it. When it comes to the engine itself, with its many working parts subject to wear and breakage, it does not seem as though it was wise to save $69.12 per engine without knowing that the results of this saving would not cost many times this, as well as considering the possibilities of wreck and disaster due to increased breakage of parts.

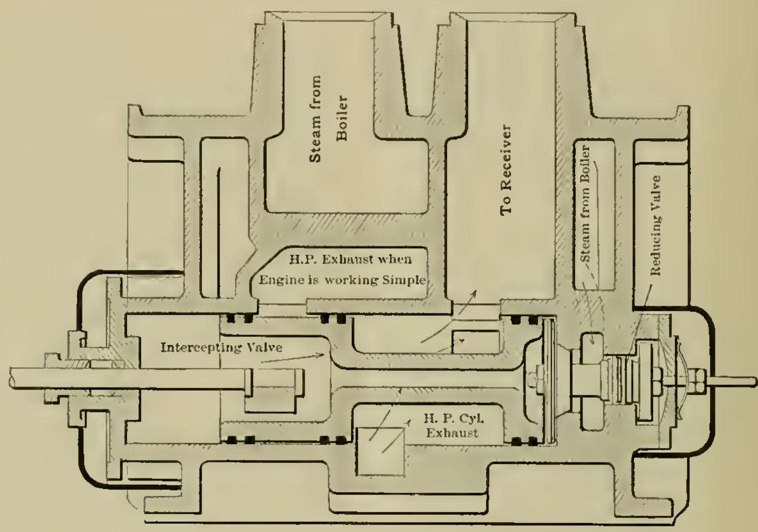
It is certainly commendable to practice all the economies possible, but it is well to be sure they are economies before making radical changes in the equipment of engines, tenders or other important factors in the railroading of today.

City Railroading.

The Brooklyn Wharf and Warehouse Company employ a number of locomotives in their work, and as the city now requires them to meter all their water, they have a meter put on every water-tank and the firemen fill the tank through the meter.

It is also necessary to have a bell ringing pretty frequently in this kind of service, and so they clamp a bell on the axle. At the speed these engines run this gives a distinct ring every revolution, and saves the fireman exercising his muscle on the bell rope.

The Q. & C. Co., of Chicago, have issued a very interesting catalog of their pneumatic oil feeding and saving system, which is particularly applicable to stationary engine rooms and power houses. The oil is forced by air pressure from a central supply to all bearings needing lubrication, doing away with men as oilers. After being used the oil is forced to a filter and, when all the impurities are extracted it is returned to the system to be used over again. It does away with men crawling around among belts to oil, and should prevent many accidents due to this kind of work. It also does away with all oil barrels and similar inflammable materials, thus reducing fire risks to a minimum. The illustrations are very clear and will make its operation clear to any one having work of this character to look after.



POSITION OF VALVE WHEN ENGINE IS WORKING COMPOUND.

Fig. 3

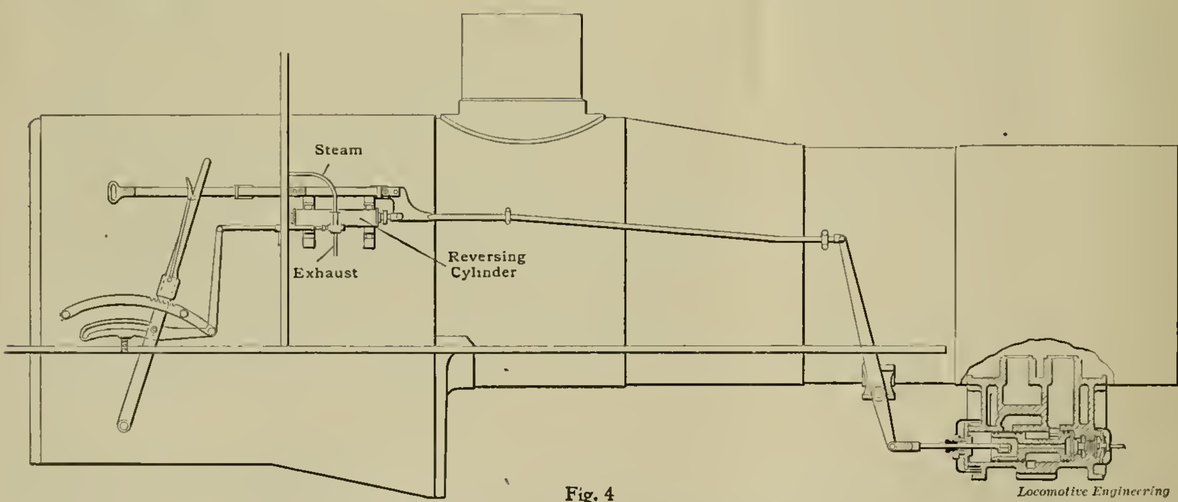


Fig. 4

INTERCEPTING VALVE—OPERATING DEVICE.

Car Department.

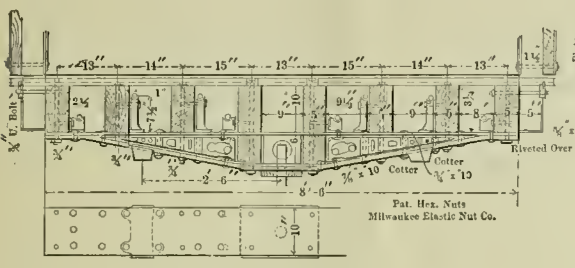
CONDUCTED BY O. H. REYNOLDS.

80,000 Pound Coal Car—Chicago & Eastern Illinois Railroad.

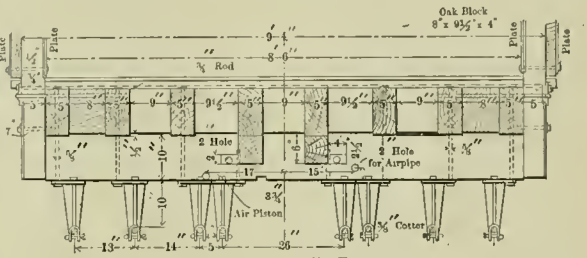
The gondola car of heavy capacity recently designed by Mr. T. A. Lawes, superintendent of motive power and machinery of the Chicago & Eastern Illinois Railroad, and shown herewith, is one embodying some difference in details from those generally seen in cars of that type.

These cars, now about ready for service, have eight longitudinal sills of Southern yellow pine, 5 x 9 inches. A search for the conventional deep outside sills will be fruitless, because they are is recognized, and eight truss rods are used to carry the load.

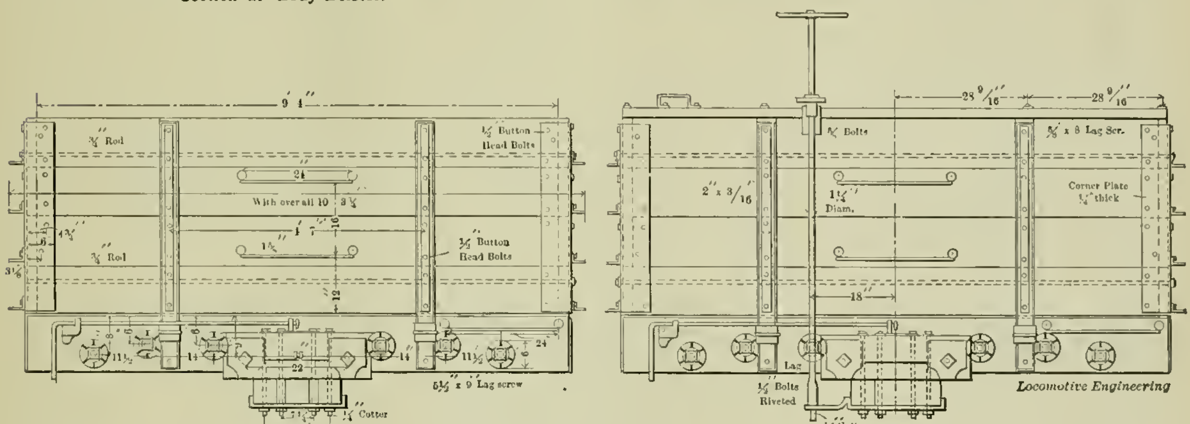
A large capacity for lading is obtained —1,176 cubic feet—without an abnormal hight of sides, by placing the latter outside of the stakes. Here may be noted another instance in which originality of thought had full sway to useful purpose, since an increase of 10 inches in width is gained by the location of the stakes inside of the side boards. The dimensions inside are: Length, 35 feet 7½ inches; width, 9 feet 4 inches; hight, 3 feet 4½ inches. All effect of overhang of the bers, extending a distance of 14 inches each side of the center, against which abuts a like casting extending from the top to ends of the bolster plates, and also strongly riveted to same. The upper member is ⅞ inch thick by 11 inches wide, and the lower one ⅝ inch thick by 11 inches wide. The spring seats are made of a channel, and support eight helical springs, 6 inches high, 5 5-16 inches diameter outside, of 1¼-inch steel. The bolster has the appearance of possessing the two requisites of lightness combined with strength, particularly the latter, as indeed it must have,



Section at Body Bolster.



Section at Needle Beam



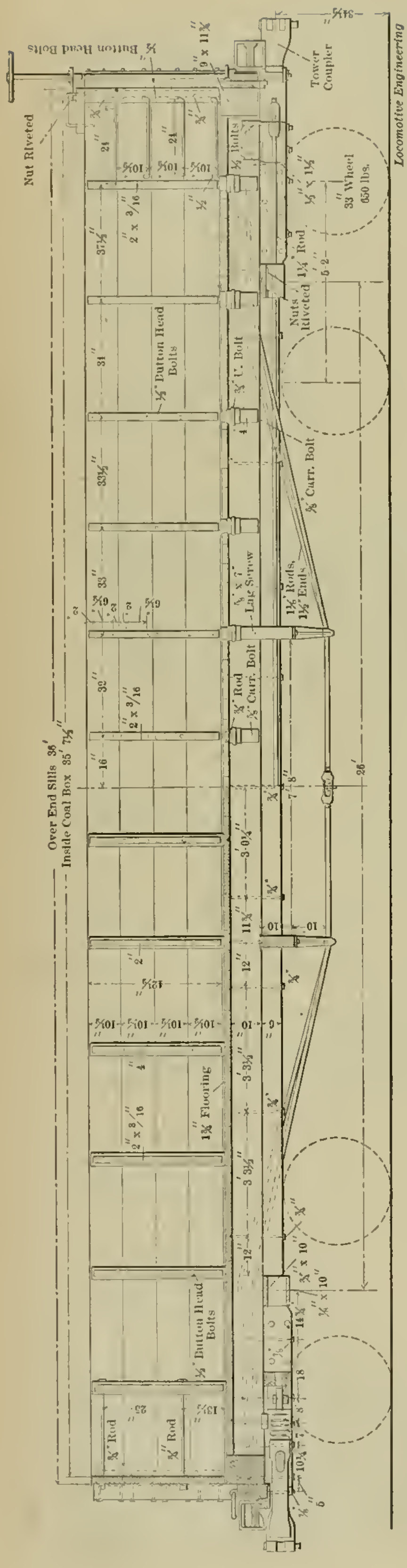
80,000-POUND COAL CAR.

not there. All sills are of equal depth, and in this change from old practice is noted a design on independent lines. In the number of sills also—eight—is seen an arrangement that explains the absence of the deep sills at the outside, for the increased number as shown practically compensates for the lack of depth at the outside, without any great increase of dead weight, that is, the car will not be appreciably heavier than one with six sills, the outside ones of which are of the standard depth used in flat and gondola car construction. There is, however, no material gain in sustaining power in the two extra sills, they simply lending an additional lateral stiffness, and longitudinal strength to resist shocks. This, it is seen, draft rigging is counteracted by the 6-inch timbers under the center sills, running from bolster to bolster, a method of centralizing buffing shocks that is no doubt fully as efficient as the inverted truss rod system sometimes used on gondola and flat cars. Southern yellow pine is extensively used, as all timbers except needle beams, end sills and draft timbers are of this material.

The truck is of the arch-bar type, and rigid, with 5 x 9-inch journals, and 650-pound wheels. The truck is equipped with the Haskell & Barker patent bolster, which consists of two wrought iron plates, 13½ inches deep over all at the center, and has a casting filler well ribbed, riveted between the upper and lower mem- to hold up under the load, with its reaction giving a continuous performance on a lever arm 3 feet 2 inches long.

Status of the Steel Car.

After passing the embryonic stage of all created things, animate and otherwise, the steel car has now reached that point when the question is no longer one of utility for service, but rather, How shall it be designed in order to give the fullest return for the labor and material put in it? This is the subject that is agitating the mechanical mind, as is evidenced by the disposition of those interested to discuss the matter in all its bearings, more at length than at any time since steel cars



CHICAGO & EASTERN ILLINOIS 80,000-POUND COAL CAR.

began to be considered as a factor in transportation. This is accounted for in a measure by the favorable attitude of railroads generally, to the strong probability of an increase in earnings with the proposed lighter car of greater load capacity.

There is, however, a wonderful difference of opinion as to design and constructive detail among those that shall ultimately have to face the problem in a practical form, and from what has already been done in propositions of this kind on paper, there is much cause to feel that a period of evolution will have to be passed through for the steel box car, similar to that which developed the wooden box car. This position is based on the fact that engineers, like other experts, sometimes disagree, and they are on record thus far with designs too widely divergent, to expect harmony until each one has had an opportunity to have the claim of superiority of his creation in steel punctured by trial.

In the division of the members of this mechanical family, one of the causes thereof is to be found in the old contention long waged in the wooden design, namely, that the superstructure of a box car should be framed in accordance with trussed bridge design, and therefore relieve the sills of a part or the whole of the load. The advantages claimed for this are lighter sills and the entire absence of truss rods, and a car of less weight than by other designs; although the critic again asks how the unprotected center panel between the door posts is provided for. Another leaning towards the bridge idea is proposed in the shape of two deep girders forming the center sills, which, with the cantilever construction perpendicular to the sills, are intended to carry the load without assistance from truss rods or superstructure, the latter supposedly as light as consistent with confining the lading.

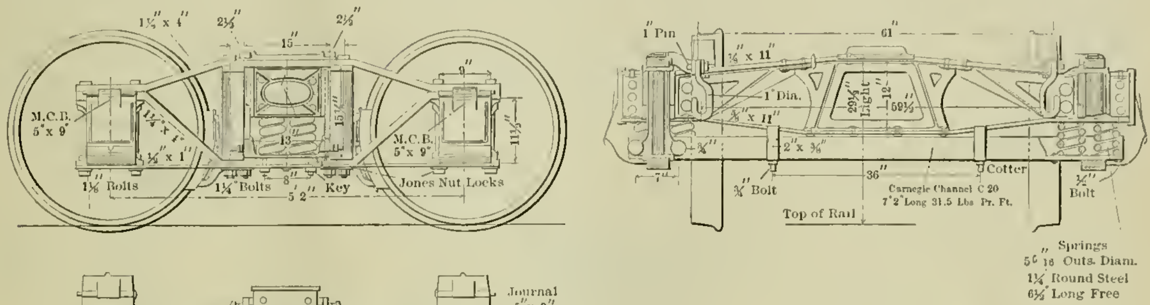
The situation is further complicated by a large following who subscribe to the belief that the load should be carried by truss rods alone, the upper framing not to be considered in any light other than as a cover strong enough to retain the load under service conditions, and the under frame simply stiff enough to resist compressive forces. All of the types mentioned have been exploited on paper and discussed; the ground has been well covered; everything bearing on the question of fitness of the proposed new carrier has received the earnest attention of the opposing interested parties, with the result that most of the faults have been dragged to light. The Master Car Builders' Association proposes to probe the subject still deeper, and their Committee on the Framing of Steel Cars is after the members with some questions which, if answered, should place the design of steel box cars on a correct basis. We would like to suggest, in this connection, that all drawings of steel box cars furnished for discussion before technical clubs, and particularly in answer to the circular of inquiry of the Master Car Builders' Association, have the fibre stresses as well as the dimensions marked on each member of the framing, and in addition to this, the estimated weight and cost of material and labor to put up the car represented by the drawing. Such a drawing would mean something and have a value beyond price, in a comparison of different designs. There are no heads of car departments at this time who wait until a car is built to know pretty near what it will cost, and since the first cost is an important if not dominant factor in this case, it should receive earliest attention.

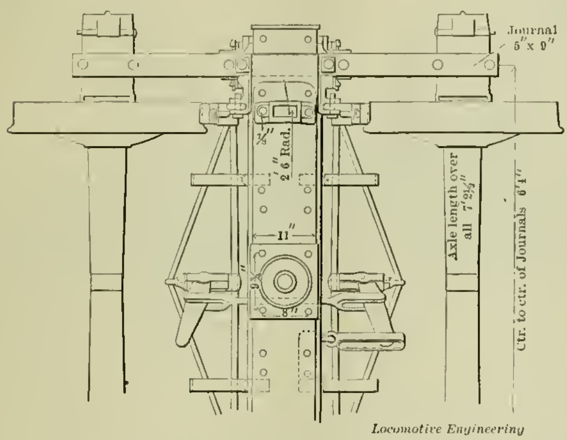
Rolling Stock on the Canadian Pacific.

The Canadian Pacific Railway have made another move in the direction of comfort for their patrons, by the introduction of a new thing in their first-class passenger cars, namely, a smoking compartment. The room is of the size and finish found in like compartments in sleeping and parlor cars, and is proving a strong card for the road—simply because it is something the traveling public wants.

In pursuance of the policy of anticipating, as far as possible, anything that can add to the pleasure of a trip across the continent, the parlor cars of this road have been made into sections by means of bulkheads across the car, with a central door. The bulkheads do not extend to the roof, but are surmounted by an elegant grill work, with an arch over the door, all finished in gold. The effect of this open work and the carving is rich in the extreme. All of the privacy of a compartment car, so dear to the heart of the English tourist, is had in this arrangement, together with the advantages of the corridor car, and we confess to a leaning in the direction of that construction for parlor cars, and also for coaches, for that matter, with chair seats of the portable kind, as used in these cars. Seats of the chair type have a wonderful fascination for the average traveller, and a voluntary effort of the line to please its friends, without the pressure of hot competition in its own territory, stands in telling contrast with the action of other roads that resort to agreements in order to avoid the expense of a few improvements.

The Hochelaga shops, at Montreal, where Master Car Builder Apps is supreme, are known to be well adapted for handling a large equipment. The erecting and repair shop is a roundhouse, and one of the few plants of the kind that was given full credit for its admirable facilities for getting out work. An unreasonable prejudice against such shops has held sway for many years, doubtless the result of an assignment of such a building to a duty it was not built for, but as a matter of fact as well fitted—and better—than many shops specially erected for car work. In this case all objections are known to be groundless. Rolling stock on this system was never in better condition than at this time, there being but 2.25 per cent. of it out of commission for repairs. This is not a statement kept on tap for newspaper men, but simply an excerpt from a recent report, and shows up pretty well when the size of the equipment is considered, and also that no cars requiring repairs were kept in service in order to give a favorable color to the report.





CHICAGO & EASTERN ILLINOIS TRUCK FOR 80,000-POUND COAL CAR.

Pennsylvania Railroad's New Limited Train.

A work of art—high art—in color and tint study and ornamentation, is the new limited train running between New York and Chicago on the Pennsylvania. It is made up of seven gorgeous examples of parlor and sleeping cars, comprising a train of seven cars. The first car is of the composite order, having a baggage room at the front end, in which is located the electric light dynamo driven by a Brotherhood engine. At the center of the car is the buffet and smoking room, with portable cane chairs, and lounges upholstered in canary-colored leather. The remaining end of the car is devoted to the uses of the tonsorial artist and the bathroom.

The dining car has ten four-seated tables, and can therefore take care of forty devotees of gastronomy at one time. The kitchen is proportionately large and well equipped for the feeding capacity of the car. The four sleeping cars in the train differ but slightly in their interior arrangements, there being two state rooms in some, and one in the others; but the color schemes and ornamentation are arranged so that the cars look entirely different—as, for example, one car has the seats upholstered in dark-blue plush, with a lighter tint of blue in the heavily embroidered head-rest covers—all making a rich contrast to the dark mahogany woodwork; while the state rooms are finished in light mahogany and gold leaf, and a light shade of upholstering. The next car, by way of contrast, has the woodwork in the state rooms of a delicate green and the upholstering in damask. The Oriental style of magnificence is further hightened by the design of the seat arms—which are supported by elaborately carved griffins, covered with gold leaf—and also by the vari-colored jewels in the deck lights.

The observation car at the rear of the trains, is also finished in dark mahogany. It has six state rooms arranged at one side of the car; these rooms can be used independent or ensuite at pleasure, the doors opening through from first to the last if required. Here again is luxury in the most complete sense, each room being finished in different colored wood and upholstering, and each also having its own toilet conveniences.

In the observation end, which takes about half the car, there are movable chairs, lounges, and those double-header, tête-à-tête affairs, which allow the occupants to revel in each other's soulful orbs. At the rear end of this car is the observation platform, about 8 feet square, surrounded by an ornate gold-plated railing. The exterior of the train is also a dream in color. The body, below the windows, is of a dark green, ornamented at the edges with a Greek border in gold leaf. Above the belt rail, all the space, including letter board, corner posts and vestibules, is of a rich cream-color, while the window frames are of a mahogany color. Besides the regular train crew, the train is accompanied to its destination by the electrician, barber, stenographer and lady's waiting-maid.

The four factories of the Nicholson File Co., Providence, R. I., closed their producing departments on Friday, Dec. 24th, for a period of nine days till Jan. 3d, in order to effect certain absolutely necessary enlargements and repairs. The executive and shipping departments remain open, to provide for the continued prompt despatch of all orders received. Extensive additions are being made to the inside equipment of the factories, while the buildings also are being considerable enlarged. The capacity of the Nicholson plant at Providence, where is manufactured the famous Nicholson Brand, willbe brought up to where it can more readily meet the demand, while the works at Pawtucket, R. I., and Beaver Falls, Pa., where are made the well-known American and Great Western brands, respectively, will be enlarged to admit of a greater production. The company plan to be in a position where they may produce an average of over 70,000 files daily after January 1st. The increased domestic and foreign demand rendered these changes necessary.

Brown & Sharpe's 1898 catalog is another advance over last year. It now has 427 printed pages, and its edges are marked "Machine Tools" and "Small Tools," so as to prevent any difficulty in finding the desired section. There is also a thumb index between the sections. This catalog is almost a cyclopedia of machinists' small tools and of machine tools, and is sent on request to the Brown & Sharpe Manufacturing Company, Providence, R. I.

Early Baldwin Locomotives on the Pennsylvania Railroad.

BY C. H. CARUTHERS.

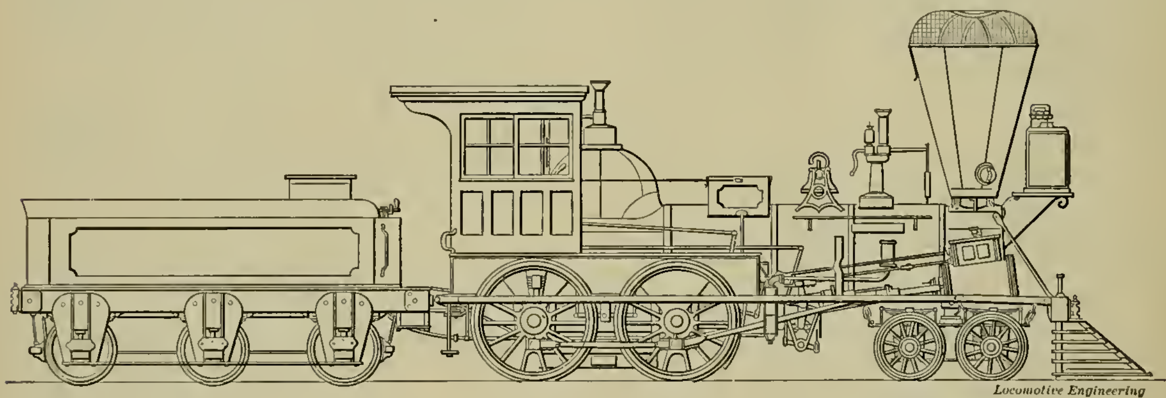
At December 31, 1857, the Pennsylvania Railroad Company owned 211 serviceable locomotives. Of these, 70 had been bought from the State in connection with the purchase of the public improvements by the railroad company, in August of the year named.

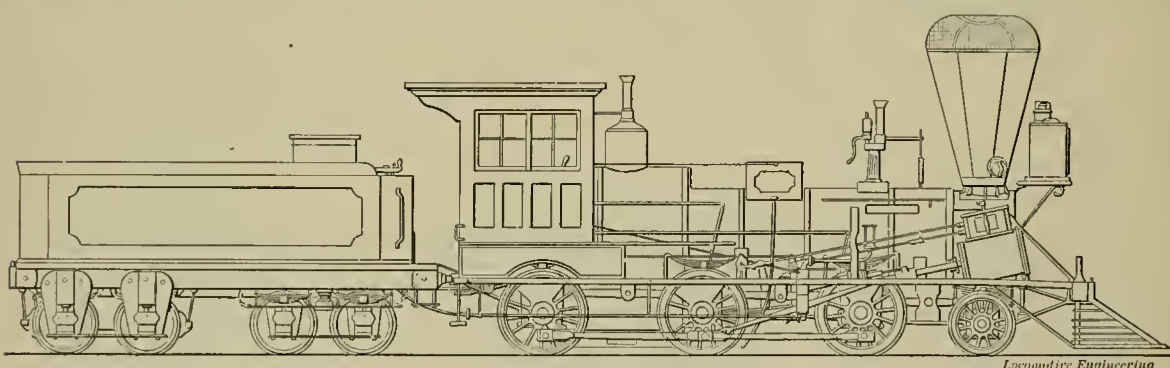
Of the remaining 141 engines built originally for the Pennsylvania Railroad, there were built as follows:

Baldwin	85
Norris	27
Winans	11
Wilmarth	3
Smith & Perkins	15
Total	141

All of these engines were named; but a system of numbering having been adopted in 1857, the names were rapidly removed, until by the middle of 1858 all were removed except from two. These two had the names cast in the sides of their sandboxes, and they remained until the entire rebuilding of the engines, in 1862.

This year of 1857 seems to distinctly mark a new era in the locomotive practice of the company, as all new engines above No. 211, especially for freight service, differed widely from those before used; all being furnished with shifting links, cylinders set horizontally, or at but a slight angle (except on a few saddle-tank engines), casings over cylinder heads, injectors; six-wheel connected freight engines having first two pairs of drivers close, and rear pair far back, to allow greater length of firebox; abandonment of outside frames, widespread truck wheels, and the substituting of brown and black for the reds and greens previously used in painting.





EARLY BALDWIN LOCOMOTIVES.

Two types of the old Baldwin engines are shown in the accompanying line drawings—a small "C," of four-wheel truck and four drivers, used both in freight and passenger service; the other a "D" of eight wheels, six connected, used entirely for freight.

The principal dimensions of the "C" were:

Cylinders—15 x 20 inches.

Boiler—17 feet 4 inches long from end to end.

Boiler, diameter—39 inches.

Firebox—44 inches long, 54 inches high, 36 inches wide (approximately); straight in front and semi-circular at back.

Driving wheels, diameter—54 inches.

Driving wheels, centers—64 inches.

Truck wheels, centers—37 inches.

Truck wheels, diameter—30 inches.

Pitch of cylinders—1¼ inches in 10 inches.

Weight on drivers—26,200 pounds.

Weight on truck—19,700 pounds.

Weight of Engine—45,900 pounds.

Fuel—Wood.

The boilers were built with large "Bury" domes, having a safety valve on the top. A column was placed near the smokestack, and it carried another safety valve and the whistle. For some reason these columns were soon removed by the company, and a different one bearing the whistle only, substituted, and both safety valves placed on the dome.

The valves were worked by single V-hooks. A positive half-stroke cut-off was used, its valve working upon a partition plate placed above the full-stroke valve in the steam chest. The outer end of this valve-rod ended in a sort of D-hook, which, by means of a lever and tumbling-shaft of its own, to which it was attached by a short link, could be lifted from or placed on the pin at the top of its own rocker arm. When off the pin, a tapered point at the end held it firmly in proper position, as this point rested in a notch fastened to the side of the boiler. This cut-off was for forward motion only, being driven by a single eccentric. The full stroke hooks were connected by links to a tumbling-shaft, which, on a few of the earlier "C" engines, was hung under the hooks, but on all later ones was placed above them. A rod united the top of the full-stroke rocker arm to a rocker near back of foot plate, and this latter rocker was fitted with pockets for starting bars.

Full-stroke pumps were used. These were driven from the cross-head, and this latter moved on two diamond bars set parallel laterally. No casings were used on cylinders, steam chests or domes. An additional frame was placed on the outside the entire length of the engine.

The tenders were small, and were carried on three pairs of wheels, generally fitted in pedestals bolted to the frame of the tender.

Twenty-three of these engines were built for the Pennsylvania Railroad Company from November, 1849, to June, 1852, and were used both in passenger and freight service for many years, a few being in service as late as 1870.

The "D" engine was a coal-burning freight engine having six driving wheels connected, and a leading wheel with boxes set in rigid pedestal jaws. The annual report of the company for the year 1855 states that these single leading wheels were removed on account of difficulty in curving, and a four-wheel vibrating truck was substituted.

The valve motion was the same as used on the "Cs." The Bury dome of the "C," however, was not used, but, instead, a large wagon top bearing a dome of very small size. The column containing whistle and safety valve was of same type as used on "C" engines, except in the case of four. On these four the safety valve only was on the top, and the whistle was on the side.

Pumps, sandboxes and much other detail were of same design as used on the "C." Brass bands originally girded the Russia iron boiler lagging on both "C" and "D" engines, but neither class used any covering on domes, steam chests and cylinders. The escape pipes over safety valves and caps over ends of axles were of polished brass, while the steam chest, with its bolts and covers, and the cylinder heads, were polished. Both classes were painted in reds and greens—the former color on wheels and the latter on tenders, cabs, frames and sand-boxes. No bells were used on the "Ds" at first.

The principal dimensions of these "Ds" were as follows:

Cylinders—18 x 22 inches.

Drivers, diameter—44 inches.

Leading wheels, diameter—30 inches.

Leading wheels from driver (centers)—60 inches.

First driver from second (centers)—78 inches.

Second driver from third (centers)—78 inches.

Boiler, diameter—42 inches.

Boiler, length over all—18 feet 7 inches.

Pitch of cylinders—22½ inches in 10 feet.

Firebox, length (approximate) inside—60 inches.

Firebox, depth (approximate) inside—54 inches.

Firebox, width (approximate) inside—36 inches.

Dome, diameter, outside—20 inches.

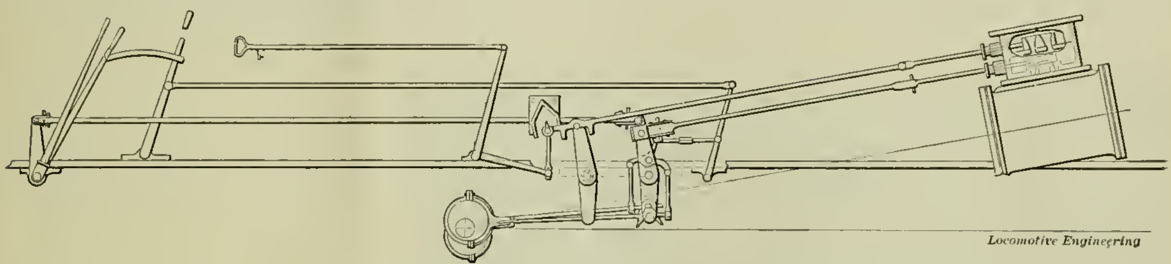
Dome, hight to parting—17½ inches.

Weight of engines—From 59,800 pounds to 65,500 pounds.

Weight on drivers—From 42,800 pounds to 46,700 pounds.

Weight on truck—From 17,000 pounds to 18,800 pounds.

Fuel—Bituminous coal.



VALVE GEAR OF EARLY BALDWIN LOCOMOTIVES.

The tenders of some of these "D" engines were carried on eight wheels, as shown in cut, viz., four in a vibrating truck and four in fixed pedestals; but the later built engines of the type used tenders carried on two trucks of same design as the one shown in cut.

They were good engines, rendered efficient service, and were not cut up until the latter part of the sixties. Eleven of this type were built for the Pennsylvania Railroad Company from August, 1852, to January, 1853, and one more was included in the 70 before referred to as purchased from the State.

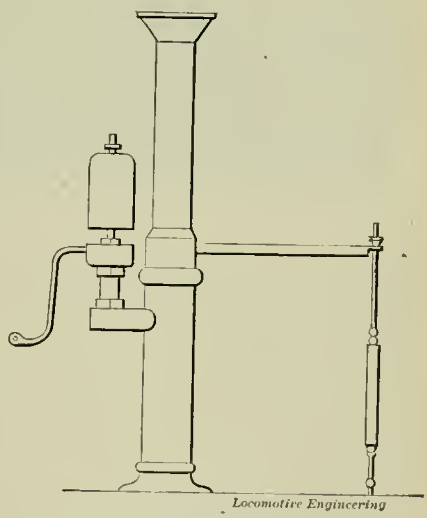
Soon after coming upon the road, the company took the last one purchased into the shop and substituted two pairs of 54-inch wheels for the second and third pairs of drivers, and put nothing in the place of the first pair. This engine ran this way until 1864, when, amongst other general repairs, it was again made six-wheel connected by receiving three pairs of new 54-inch wheels—the original frames being still in the engine.

The column with whistle and safety valve remained on these "D" engines many years.

Adamsford, Pa.

Rather a peculiar accident happened on the Morris & Essex division of the D., L. & W., the other night, which delayed several of the local trains loaded with hungry commuters, who were, of course, pleased at the delay. The grates dropped out of the fire-box of one of the express engines and dumped the fire on the track. This rather discouraged the steam end of the locomotive, and the train had to be pushed by the following train until another engine could be procured.

A short time ago, a recently appointed and consequently officious postmaster in a little Wisconsin town complained to the Chicago & Northwestern agent that he was not supplied with the current official division time-table. The agent seemed to doubt that the company would consider it the postmaster's business to know when all freight trains were due, and hence enquired of the latter why he should expect it. "Why," said the P. M., reaching for the agent's time-card, hanging near, "dont you ever read what it says right here on the first page, and in big letters, too?—'For the Government and Information of Employés Only,' and I am the only government representative here in town."



ESCAPE PIPE OF EARLY BALDWIN LOCOMOTIVES.

D. D. Martin, manager of passenger traffic of the Baltimore & Ohio Railroad, says that the withdrawal of the Michigan lines from the interchangeable mileage agreement will not affect the popularity of the ticket.

Electric Locomotive No. 1.

A trial of the first electric locomotive built for the Hoboken Shore road by the General Electric Company, occurred on January 4th, in the presence of a large number of railroad men and others interested in the application of electricity to freight haulage. The locomotive was designed to transfer freight along the shore line betwen railroad freight yards and the steamship docks on the Hoboken side of the Hudson River.

This locomotive shown in our half-tone develops a draw-bar pull of 10,000 pounds with 500 volts, at a speed of eight miles an hour. The test train consisted of eight loaded freight cars of 60,000 pounds capacity, weighing with their lading 296 tons. The load was successfully moved at a very slow speed, the locomotive starting and handling the train without shock. This driven by 3 horse-power iron-clad bipolar slow speed motor. The operation is automatic. When the air in the reservoirs is at normal pressure, the governor switch is opened. Blowing the whistle, applying the brake, or using the sand apparatus causes the pressure to fall, this closes the switch and starts the motor and pump. The locomotive is 29 feet long over all; greatest width, 8 feet; hight over trolley stand, 13 feet; wheel base, 5 feet 6 inches; weight, 57,000 pounds. The eight cars in the test train, together with the locomotive itself, weighed 296+28=324 tons. Taking 15 pounds per ton as a liberal estimate of the power to overcome the resistance of the train's inertia, the locomotive should start $\frac{10,000}{15} = 666$ tons, or more than twice as great as the load started. The horse-power required to velop a horse-power for the least money in this service is a question of lively import and one that from the present outlook bids fair to have an early and convincing solution.

ELECTRIC LOCOMOTIVE.

machine is generally similar in appearance to those engaged in freight service on the Baltimore & Ohio Railroad, at the Belt Line Tunnel, though of considerably less capacity than the latter. It has two four-wheel trucks, with a G. E. 2,000 motor on each axle, which gives a total horse-power of 540. The motors are driven through a single reduction gear of low ratio, and the speed of the locomotive is therefore low when doing maximum duty.

In the interior of the roomy cab is a controller of the series parallel type known as the L 2. There is also the magnetic blow-out which is arranged to operate the motors, either four in series, or each two in series—multiple. The air-brake handle and the two valves of the sanding system, by which the rails are sanded by compressed air, are within convenient reach of the motorman. In front of the latter is the air-brake gage, and above that is the ammeter reading to 500 amperes. The automatic circuit breaker, set at 500 amperes, is secured to the roof of the cab. At one side of the controller is an M circuit breaker and an automatic governor switch for the air pump, which is a single cylinder move the tons actually hauled at a speed of 8 miles an hour equals $\frac{324 \times 7 \times 704}{33,000} = 48$, calculating the resistance at 7 pounds per ton to keep the train moving at 8 miles an hour. These figures seem to demonstrate that the machine has an ample reserve of power to draw on, which was shown by a tendency to slip, and showing a hauling capacity equal to that of a 15 x 24 four-wheeled switching engine, which with drivers of the usual size for that type of power—49 inches—will exert a drawbar pull of $\frac{15^2 \times 100 \times 24}{49} - 10\% = 9.918$ pounds. The two engines being practically of the same weight and power, afford a means of comparison of the agents between steam and electricity for the same work, in this instance. In a competitive trial of the two engines in this class of work, we are of the belief that the steam engine would handle the work with greater dispatch, an item of the most vital moment in a crowded yard. The electric locomotive, however, has the advantage of not hauling a tender weighing 45,000 pounds. Which one of these can be made to de-

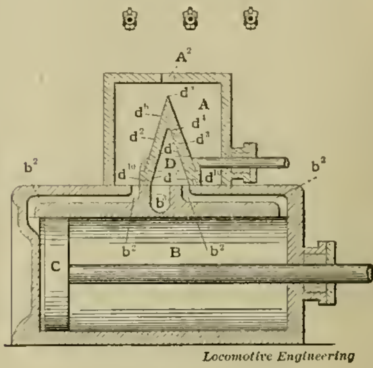


Fig. 1. DE GROFF BALANCED VALVE.

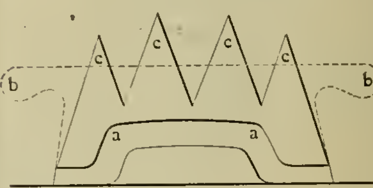


Fig. 2

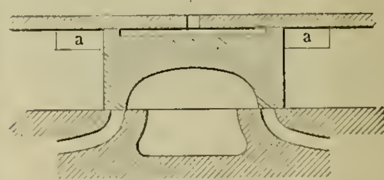


Fig. 3

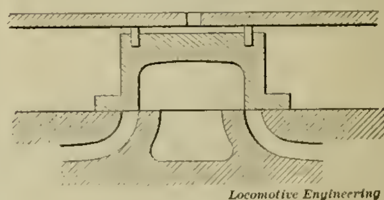


Fig. 4

BALANCING VALVES.

Balanced Valves.

The question of pressure on the back of a valve is one which sometimes puzzles men, particularly if the back of the valve has corns and bumps on it, or isn't made as most well-behaved valves are.

Many have tried to fool the steam into not bearing down with its full strength on the back of a valve, by making the back of such shape that it couldn't get a fair hold, so to speak, but would sort of lose its grip and slide off sideways. Needless to say that instead of fooling the steam the inventors only fooled themselves—and their backers. Our genial correspondent, John Alexander, made this the subject of one of his object lessons in February, 1895, but as we understand that it is again being pushed into prominence, it is worth while to show its fallacy again.

The illustration gives a clear idea of the "hen coop" plan, and the letters d_2, d_{10}, etc., show where the steam is to be deluded into pushing against the sides of the coop instead of bearing down on it, and all the time the valve would be waltzing back and forth in joyful glee to think how it was fooling the steam.

The balancing of a valve depends on the "projected" area of the valve at right angles to its face, leaving out the question of the ports and the pressure due to compression under the valve.

In Fig. 2 the projected area remains the same whether the valve be shaped as shown at *a*, *b* or *c*. In *b* the pressure under the "eaves" of the valve balances that on top of them. In other words, the area of the face of the valves is what requires balancing, regardless of the Queen Anne roofs and dormer windows on the top of the valve.

The simplest form of a balanced slide valve is probably that shown in Fig. 3, by solid lines, supposing, of course, that the joint between the valve and the balance plate on back is practically tight, the vent hole providing means of escape for any slight leakage. If provided with the ears shown by dotted lines *a a*, the valve would be overbalanced and would have more pressure against balance plate than on the seat. They would also probably leak quite a little. Fig. 4 shows roughly the general form of Richardson balanced valve, two of the strips being shown in place. The American type has circular balancing strips or rings, which perform the same office of keeping pressure off the back of the valve.

In practice it is not common to balance over 60 per cent. of the valve area, although there are cases where as high as 95 and as low as 48 per cent. of the area is used, but 60 per cent. seems to be a fair average.

This has been derived by carefully considering the effect of the ports, compression, etc., but don't dream that you can balance a valve by giving it a steeple top or in any other way except by relieving pressure on the valve seat in some such way as shown, or a better way if you can devise one that doesn't try to fool the steam—that's a hard job.

January Meeting of the New York Railroad Club.

The interesting paper on "Tonnage Rating" prepared and read by L. R. Pomeroy before the New York Railroad Club, on January 20th, was the opening gun for 1898, and coming up, as it did, at a time when the railroads of the country are actively engaged in a solution of the question as to how best arrange tables or charts for the use of train masters or yard men in the making up of trains, it proved a subject of the liveliest interest to the members of the club.

The paper is a valuable compilation of the best work done in the line of train rating, and brings the whole subject right down to the present time. The original charts devised and presented by the author were not the least creditable feature of the paper, and were very favorably received. In the discussion that followed there was no dissenting voice in the hall, and it made the fact patent that the Chicago Great Western, the New York, New Haven & Hartford, the Southern Pacific and other roads that had determined the capacity of their power by tests made with a weighed train, had touched bottom when they solved the problem of loads for their engines by actual hauling tests.

The capacity of an engine is one thing when theorizing with a pencil, and quite another when loads are hanging on the draw-bar. The testimony of all is now based on the practical determination of load capacity, and with the added suggestions conveyed in the paper and discussion of it, there may be said to be very few obscure features in the subject.

Handling Material.

Every shop and roundhouse man knows that the handling of material is a costly item in many places and that methods to avoid unnecessary handling are much to be desired. A striking example of this was seen in New York the other day in construction of the thirty-story skyscraper which is going up on Park row. Instead of unloading a load of bricks and then reloading onto an elevator, the horses were unhitched and the whole thing, wagon and bricks, hoisted to the eighteenth floor to be unloaded. This saved two handlings, and as the cost of hoisting was practically the same in either case, this was almost a clear saving.

Cast Iron Engines.

Some years ago Mr. X—, the locomotive superintendent of one of the largest roads in England, brought out some "cast-iron" engines, as he called them; he had put in cast-iron just wherever he could get it. For some reason or other these engines ran hard.

One night, in the London terminal station, Mr. X— walked up to one of these engines, and accosted the fireman who was sweating away there, trying to induce the bars and clinkers to part company. He did not know Mr. X— by sight.

"Good evening, fireman."

"Good evening to you, sir."

"Had a good run up?"

"Pretty fair, sir."

"This is one of Mr. X.'s cast-iron engines, I believe, isn't it?"

"Yes, sir."

"How do you like them?"

"Well," answered the fireman, slowly and emphatically, "all I've got to say is this: when he made his cast-iron engines it was a d—d pity he didn't make some cast-iron firemen to go with 'em."

Exit Mr. X., deeply ruminating.

New South Wales Exhaust Pipe.

Referring to the exhaust pipe illustrated on page 741 of our October number, Mr. D. H. Stewart, Penrith, N. S. W., one of the inventors, writes us:

"Let me, through your valuable journal, ask your readers to take another glance at what you call 'a curious form of exhaust pipe'; and remember, when looking at it, they see something useful, if it is curious. It will create about 5 inches of vacuum on the exhaust side of the piston, and thus relieve the engine considerably; and if used in connection with compound engines, it will go far to making them a success. This pipe, with its cones and ports marked *F*, acts just the same as an injector. It will pick up water and throw it a considerable distance. It does away with the necessity of two exhaust pipes, and still gives a good vacuum in the smokebox. But the principal thing it was invented for is to relieve the engine of back pressure—a thing American engineers, above any, recognize the necessity of. The two cones with the ports *F* being enclosed in a vacuum chamber, enables the exhaust steam from one engine to create a vacuum in the exhaust pipe of the other, thereby enabling the engine to work as with a condenser. The vacuum chamber is made in two parts and fastened together with three clips, so that the cones which are held in place by the chamber can readily be removed.

"I was under the impression that this invention would have speedily been given a trial in America. But perhaps I have not gone the right way about it. If so, will some of your interested readers write me? I shall be glad to further explain, if necessary, or send drawings."

The measurement of the quantity of water passing through a water main is an interesting problem to engineers, and probably no device has met with such practical success as the Venturi meter, invented by Mr. Clemens Herschel, and called after the philosopher of this name, who, in 1796, first called attention to the principles on which this is based. Those interested can obtain instructive data by applying to the Builders' Iron Foundry, Providence, R. I., who make this meter.

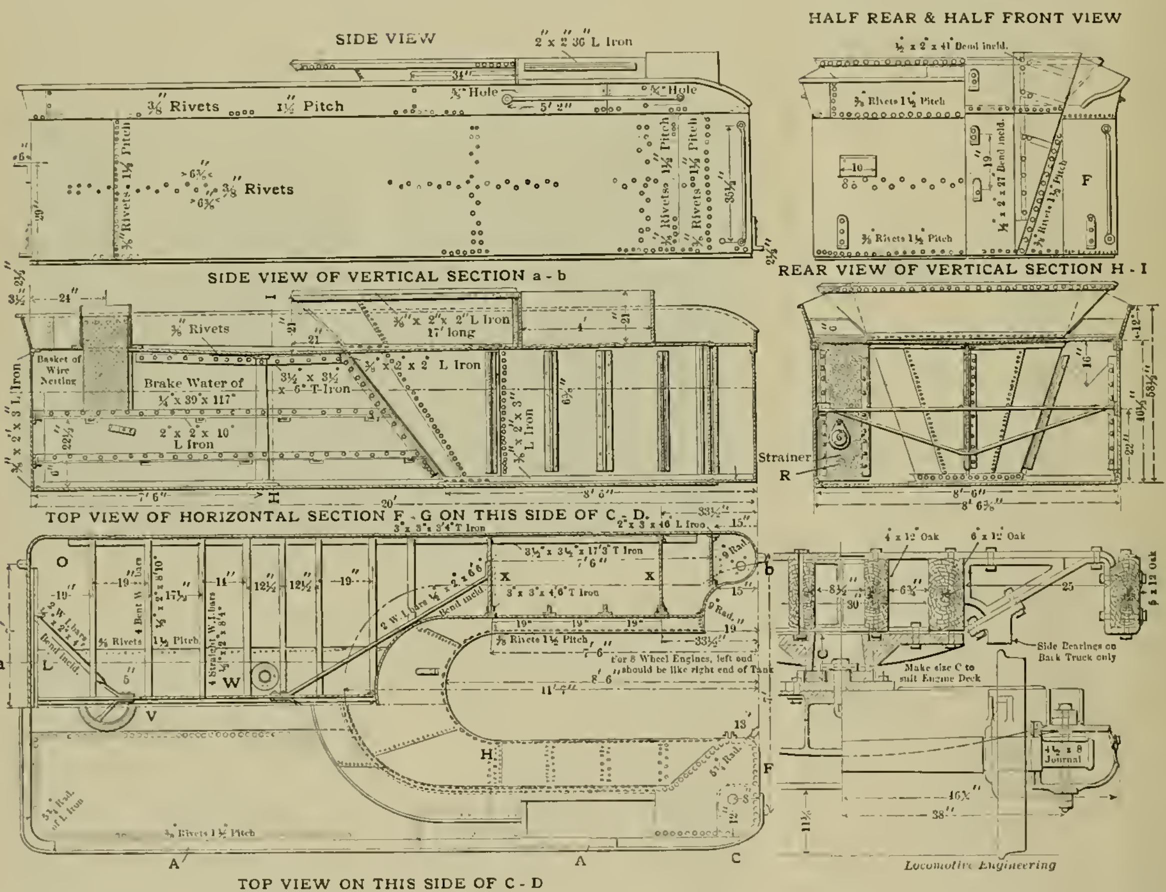
We have received from the Grand Trunk Literary and Scientific Institute a copy of the fortieth annual report, which indicates that the society is in a highly prosperous condition.

Missouri Pacific Tender.

The new tender of the Missouri Pacific Railway, shown in the accompanying engraving, is one gotten up during the year just passed, and has improvements that are intended to make it fully up to the line laid down for their products. An inspection of the working drawing will reveal some things not seen in tank work generally—some points that present a favorable appearance on paper, at all events.

It will be noted that there is a wire netting strainer in the man-hole, the object of which is plainly to prevent entrance into the tank of any solids that are likely to prove a gag to the injector, and the same precautionary measure is seen in the water legs at the point of connection with feed hose, to intercept anything that might get by the man-hole. The coal pit has sloping sides and end, which is a good thing for the joints, and increases the water capacity quite a little, with but slight reduction of that for coal, at the same time compensating somewhat for the concavity of the end of the left leg for the convenience of the fireman. The arrangement of frame is given in section, with dimensions that show a solid but light frame for a tank 20 feet in length.

In the half sectional elevation of the truck, which is of the diamond type, a good conception may be formed of the stability and solid character of its construction. The swing hangers of this truck—one of its most important features, on account of novelty in design—are not shown, for want of space; but to them is due the smooth action of the truck under all conditions of track.



MISSOURI PACIFIC TENDER.

Liking for American Locomotives Abroad.

The indications are that within a very few years American locomotive builders will supply their product to all foreign countries that do not build their own engines. Owing to their perfected system of production, American locomotive builders can furnish an engine considerably cheaper than the work can be done in any other country—they can even beat Germany, where hours are long and labor cheap. Nations are like individuals so far as buying and selling are concerned—they purchase at the cheapest market and sell where they can get the best prices.

We have sold locomotives abroad during the last five years (to June 30, 1897) as follows:

	Number.	Value.
1893	195	$1,794,709
1894	142	1,028,336
1895	252	2,379,519
1896	261	2,512,270
1897	338	3,225,831

The following figures show the distribution of American locomotives among our best customers for four years:

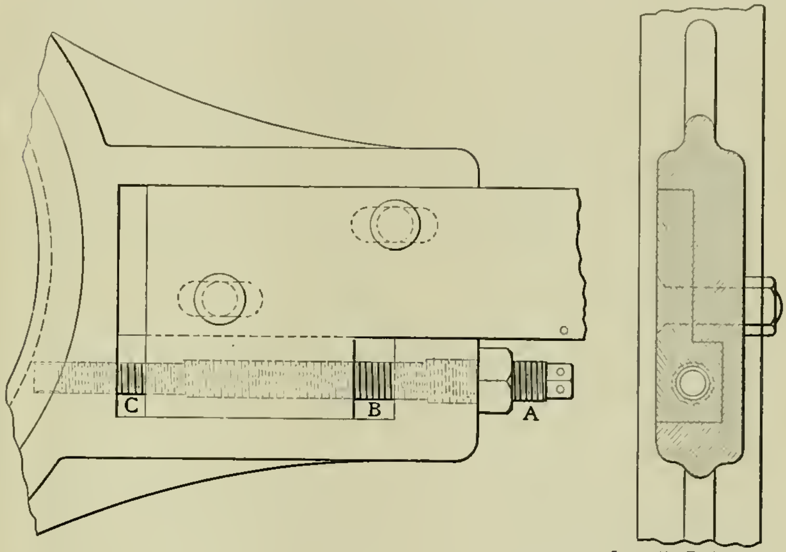
	1893.	1894.	1895.	1896.
Brazil	77	26	138	84
Chile	7	24	8	22
Cuba	56	33	36	4
Japan	—	15	23	23
Mexico	26	6	7	23
Russia	—	—	2	74

The American locomotive is received with peculiar favor abroad. There is something in this particular line of machinery that places it almost above competition. The preference shown for it is very remarkable.

Adjusting Screw on Eccentric Rods.

Some little ingenuity has been exercised in the application of a screw to an eccentric rod for the purpose of changing its length, by either a fine or coarse movement. The screw with a jamb-nut is shown in our engraving of this device, tapped into the outer and inner ends of the strap arm at *A* and *C*, and also into the rod at *B*, the rod being enlarged at *B* to receive the screw, as shown in the sectional view.

The thread on the ends of the screw at *A* is 1⅛ inch diameter, and that at *B* is 1 inch diameter, while the end *C* is ⅞ inch diameter. The two ends are threaded the same pitch, but are made half the pitch of the central part *B* through the rod. By making the pitch ratio as stated, the screw and eccentric rod will have a movement of like distances, but in opposite directions. This arrangement is a refinement in rod adjustment that will appeal to the valve setter as an easy and positive way to change the length of a rod, as compared with the uncertainties of a jar with a hammer. The expense attending the fitting up, however, will no doubt prevent its general use. The device is the invention of W. N. Reazor, Waverly, N. Y.



ADJUSTING SCREW FOR ECCENTRIC RODS.

The Slide Valve and Eccentric.

It is not a matter of common knowledge that the slide valve, as used on the locomotive, did not have any outside lap until 1838, or nine years after the Rainhill competitive tests, and its only function at that time was to merely cover the ports to prevent admission at both ends at one and the same time.

There appears to have been no understanding of the effect of outside lap on the distribution of steam, up to that date. De Pambour in his writings on the locomotive, just prior to the above year, avoids all reference to lap. Lead, on the contrary, is very fully treated.

At the time stated, lap began to make its appearance, but to a very slight extent, showing that its development was to be on tentative lines rather than in obedience to any worked-out theories in advance of trial, for the Camden & Amboy Railroad then had all of its engines running with 1-16 inch outside lap. As if to mark the year 1838 as a calendar date in locomotive engineering, the slide valve was first actuated at that time by the link, and its history of sixty years shows that lap and the link have been inseparable in the progress of the slide valve.

The eccentric, on the contrary, has remained the same eccentric since 1799, when it was invented by Murdock, Watt's foreman and co-worker. Unchanged, because no opening for improvement was left by its inventor, it stands alone as an example of the survival of the fittest.

We have received from the Young Men's Christian Association connected with the Chicago & Northwestern Railway, a folder giving a great many details regarding the fine building which this association has lately erected near the West Chicago shops, and particulars about the work the society is doing. It seems to be doing as good work in this line as any of the sister societies, and all of them are proving of great benefit to railroad men.

Surveys are about to be made for the railway to connect Shanghai with the trunk line from Pekin to Hankow, and the construction is expected to begin as soon as possible. It will probably be constructed by British engineers and capital. Railroads are truly said to be the greatest aid to civilization which has yet been produced.

Reclaiming Wasted Coal.

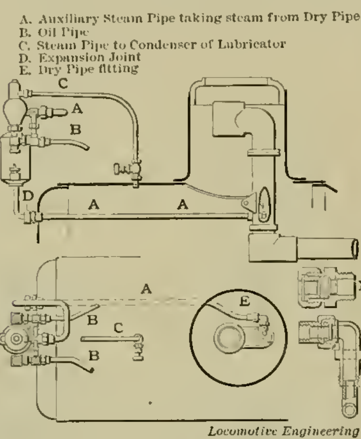
The Reading Railroad Company, it is stated, has begun the work of reclaiming the great masses of anthracite coal now buried in the mountains of coal dirt scattered all over the Schuylkill coal basin. During the season just closing 50,000 tons of good coal were reclaimed from the coal dirt near Kalmia colliery alone. Kalmia colliery is now abandoned as a coal mine, having been worked out. It was one of the very best of the Reading Coal & Iron Company's properties in the west end, and its product was vast in the many years of its active operations. Now the company has turned its attention to reclaiming the coal in the dirt mountain at the colliery. Suitable washing machines were put in, and quantities of first-class coal are being taken out of what was considered a great black mass of worthless dirt. There is no way of estimating the weight of all these mountains of coal dirt in the three Pennsylvania anthracite coal basins; but they are all valuable, especially where there is a plentiful supply of water. In recent years the discovery has been made that pea coal is a first-class fuel. They now take out and classify not only pea coal, but buckwheat and rice as well. The company is able to make at least $1 clear profit a ton on this washed coal, which would make $50,000 clear profit on the Kalmia washery alone. Individuals have gone into the business, and are doing very well. In a short time, it is probable, many more will be engaged in washing out good coal from these dirt heaps, some of which are 200 feet in hight and cover ten acres. At one big dirt bank a very rich find has just been made. During the war the demand for lump coal for United States vessels of war was so great that several of the Reading railroad collieries could not stop to bother with small coal. The rush for lump and steamboat necessitated the pushing of small coal out of the way in order to hurry up the shipments of the big coal. This small coal went out on the bank and was soon covered up by the dirt from the breakers and buried out of sight, to remain there for thirty-five years. It has now been discovered, and it is thought it may prove to be worth hundreds of thousands of dollars.—"Industrial World."

Tippett Attachment of Detroit Lubricator.

The accompanying illustration shows what is known as the Tippett attachment, applied by the Detroit Lubricator Co. to their sight feed lubricators, for the purpose of securing a steady feed against the back pressure of the cylinders.

Since the higher steam pressures have come into vogue there have been a great many complaints of the lubricator not feeding oil to the steam chests when engine was running with a full open throttle. The Tippett attachment consists of a pipe leading into the dry pipe of the locomotive and connecting with the two oil pipes. When the throttle is open, an extra current of steam is admitted into the oil pipes which overcomes the back pressure and creates a constant current in the oil pipes towards the cylinders as long as throttle remains open.

In the diagram showing the lubricator with the attachment connected to the locomotive, *A* is the auxiliary steam pipe, taking steam from the dry pipe; *B* is the oil pipe, *C* the steam pipe to the condenser of the lubricator, *D* an expansion joint and *E* the dry pipe fitting. The last named parts are shown in detail in detached views. Lubricators with this attachment are in service on several leading railroads with so satisfactory a record of service that they are being specified for attachment to new power being built. It is said that in every case in which they have been used the efficiency of the engine has been increased without increasing the quantity of coal used, and on account of the more complete lubrication furnished to the valves the reverse lever can be operated with greater ease.



TIPPETT ATTACHMENT OF DETROIT LUBRICATOR.

The catalog of the Detrick & Harvey Machine Company, Baltimore, Md., showing their bolt and nut machinery is at hand, with a very attractive and interesting exhibit of their accurate threading devices. They embrace the best points in tools for bolt cutting and nut tapping, claiming absolute uniformity in diameter and pitch in their products, which cover a range from railroad to bicycle work, taking in bolt pointers and nut facers, and running the gamut from the single to the six-spindle nut tapper, up to the lead-screw bolt machines, the refinement and best development of screw-cutting machinery. The engravings are half-tones and the letter press clean cut, explaining clearly all points the purchaser wants to know, including the price of the tools.

Horizontal Borer as a Milling Machine.

Some time ago we had occasion to refer to the transformation of a horizontal borer into a milling machine, on the Great Northern Railway at St. Paul, by the application of a feed arrangement and a few minor parts needed to effect the combination, and which, applied or removed, would not make the tool any less efficient in the work it was primarily intended to do.

This action was taken, as stated at the time, to help out on a class of work that was away in the rear for want of facilities to handle it. Idle moments were common to the borer, while the milling work was stacking up around the tools and waiting; something simply had to be done to relieve the stagnation.

What was at that time taken up as a "forlorn hope" has since developed into standard practice by providing mills to turn out work that had never been milled before, at least in that shop, and as a matter of fact invading the field of the planer on some jobs that had been held sacred by planer tradition as the only way to do that particular kind of work.

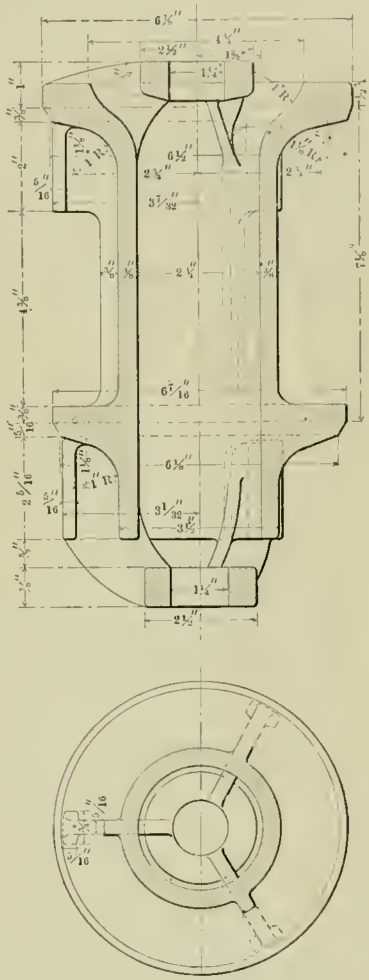
In the case of slide valves is this particularly true, in which the gang mill was made to give up results surpassing those obtained in the regulation way, by cutting out the slot for the balance strip and facing off the end of the valve, besides truing up the top of flange as well as facing the end of same, all at one setting. The sides treated the same, and the working face of the valve also milled, was all the proof needed that the machine was adapted to milling as well as boring.

There is in existence, among shop men, a well-grounded feeling that combination machines are not the correct thing to reduce shop expense. This may have some foundation as far as manufacturing of a special line of work is concerned, but in a railroad repair shop where the character of the work is kaleidoscopic, the objection does not hold, and while tool builders stand ready with their arguments against such practice, since such a tool may deprive them of a market for others, it would seem the proper thing for them to foster these combinations and build on the lines found to be those best calculated to fill the requirements of the railroad shop—thus anticipating the improvements of the live shop foreman, and work up a new market for an improved tool.

If anyone wishes to obtain a calendar that can be seen at a long distance, they should send to the Ajax Metal Co., Philadelphia, for their calendar for 1898. It is got up in a very artistic style, shows the works of the company and the gentleman from whom they took their name in a brilliant light made by the shafts of electricity.

Canadian Pacific Regulator Valve and Crosshead Pin.

Throttle valves of the poppet type, or regulator valves, as they are known on the Canadian Pacific Railway, were addicted to leakage, due to unequal expansion between the valve and seat or case containing the valve, just the same as was their wont on other roads. Mechanical Superintendent Atkinson understood the cause for that performance, and proceeded to correct it by coring the valve, as shown in the engraving.



Locomotive Engineering

CANADIAN PACIFIC THROTTLE VALVE.

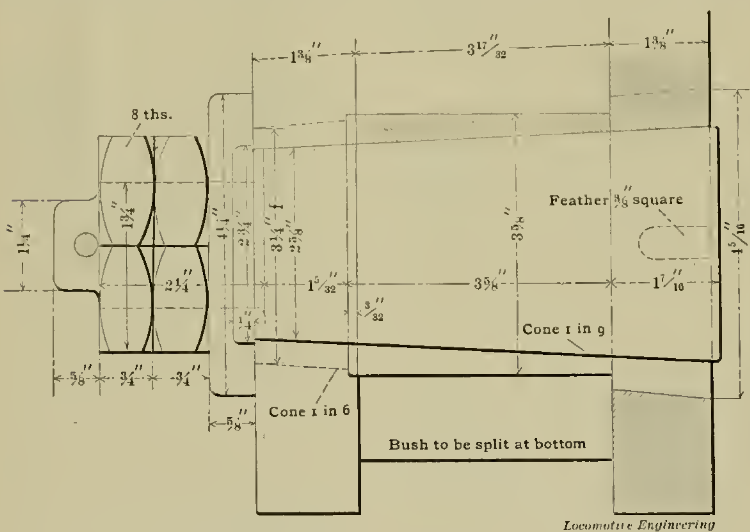
The metal at the center of the valve is removed, leaving it practically a hollow shell, and thus similar in section, or nearly so, to the case containing the valve seats. Steam being unobstructed in its passage through the valve shell at the center, plainly expands the metal in valve and seats to the same amount, and preserves the same degree of contact between those points under all temperatures, thus preventing leakage after the joints are once trued—a simple way to remove a serious element of danger, and the wonder of it is, that these valves should be used for so many years before anyone could think of a remedy for the trouble.

Crossheads of the underhung style are equipped with a split bushing to take the wear of the brass, the bushing being prevented from turning by a feather. The whole thing is clearly shown with the tapered pin in place in the crosshead, from which it is seen that the pin will wear out any number of bushings, and that the latter will stand a few turnings before the scrap pile can claim it.

Putting Off the Time for Studying Train Mechanism.

The office of LOCOMOTIVE ENGINEERING is a barometer that indicates the movements of air-brake instruction cars, and of the issuing of orders that train men shall be subjected to examination for fitness before being promoted. The force train mechanism as soon as a position in train service is secured. Reading will excite sufficient interest to lead to study. A man who follows this practice is learning new things every trip, and he is well informed concerning the science of his work long before he has the opportunity to go up for examination.

There is a certain kind of coal which, when burned in the fireboxes of locomotives puts a clinker upon the flue-sheet that gradually covers up the flue openings and greatly reduces the boiler's capacity for steam making. In short, puts the engine in the condition that no man can "keep her hot." The best remedy for this annoyance is to keep a supply of broken limestone upon the tender, and throw a shovelful of that stone into the firebox about every hour or two. Two shovelfuls



CANADIAN PACIFIC CROSSHEAD PIN.

that moves our barometer comes in the form of orders for books on the air brake and others dealing with the care and management of the locomotive or on combustion.

Among a great many train men the evil day of preparing to pass an examination is put off until it is too late. When a man gets a position as fireman, he resolves to study the principles of his business long before his turn for promotion comes round; but he keeps revising the resolution without entering upon performance. Weeks slip into months, months into years, and yet no studying has been done. Then he receives intimation that he will be called up for examination on a certain day, and a rush is made for the books that will help him to the information required. That man is unusually lucky if he manages to pass.

It is much the easier plan to begin reading books about the locomotive and other put in before starting will generally keep off the clinker for a whole division. The clinker is a silicate of soda, which means a peculiar combination of quartz and soda. When the gas gets mixed with lime it loses its power to settle down as scale.

The Rhode Island Locomotive Works were sold on January 6th at public auction. They went to Eugene W. Mason for $130,000. We believe that the works remain in the hands of the old owners.

The Big Four are running some of the handsomest and most comfortable trains to be found in the country. Their dining car service is particularly good.

Low furnace temperature and deficiency of oxygen are the most potent influences in the creation of smoke.

Edward Marsden, a student in Lane Theological Seminary, at Cincinnati, is said to be the first native Alaskan to receive a legal, theological and business education in America. He has also acquired mechanical engineering and the trades of carpenter, bricklayer, housepainter, tinsmith, piano tuner, clock repairing, bookkeeping and typewriting. He must be a sort of modern Admirable Crichton; but we are afraid that his acquirements must have been spread so thin that none of them would prove of practical value. We never met a jack of all trades who was worth his salt.

Under the caption of "Screw Threads," the Jones & Lamson Machine Company, of Springfield, Vt., have issued one of their always attractive catalogs, showing the merits and advantages of their system of screw-cutting dies, which gives an inaccuracy of less than one sixty-fourth of an inch in 18 inches. If desired this can be reduced to three-thousandths of an inch in the same length. This is interesting to all mechanics, and their staybolt-cutting device appeals particularly to railroad men.

True Account of an International Race.

The humorist of the *Railway Age* has had the audacity to poke fun at our S. P. on account of his well-known predilection for oatmeal porridge and for bicycle riding. In the absence of our chief, who has gone upon a lecturing tour, the lower lights of the editorial staff submit a true history of the case.

It is well known that our S. P. is an ardent bicycle rider, and that he started out last summer to break the record in New Jersey, where he resides. At a time when he was losing ground with a few younger bykeists, the Joseph Dixon Crucible Company very seasonably sent him a supply of chain lubricant, called "Grapholita," which helped him to regain lost ground, and the fact was thankfully acknowledged in Locomotive Engineering.

An old rivalry existed between the S. P. and Shandy Maguire, the Brotherhood poet. Years before, they had been engineers on the same road, and Angus made more locomotives ready for the back shop than Shandy had ever been able to put in the same condition. This always stuck in the poet's crop. The sleeping jealousy moved Shandy to send a poem to the *Locomotive Engineers' Journal*, challenging our S. P. to an international contest with the bicycle. When the race came off, both landed, at the finish, in a ditch at the base of Orange Mountain, and so close was the header from byke to mud, that John A. Hill, the umpire, and the referees held that the race was a draw. Here is what the *Railway Age* "inspector" says about the challenge:

"It is seldom that an interchange of editorial courtesies produces anything as interesting as the reply of Angus Sinclair to a challenge from Shandy Maguire, of the *Locomotive Engineers' Journal*, induced by the former's story entitled, 'The Triumph of Oatmeal; or, How I Learned to Ride a Bicycle.' The usual rule that when Irish meets Scotch there are two kinds of whisky seems likely to be modified if this great event ever takes place. Here is Angus' reply:

'Why, Shandy, man, my friendly brither,
Your challenge threw me in a swither,
But noo I've pulled my pluck thegither
And breathe defiance;
So, if you're game, come hie you hither
And show your science.

'Tho' you may ride wi' reckless spinnin',
And think that plan the best for rinnin',
I fear, my chum, that you're beginnin'
To boast your paces.
Not to the swift aye ends the winnin'
O' hard-fought races.

'When saft October breezes blow,
And Orange woods in crimson glow,
I'll meet you there, my lusty foe,
Our speed to settle.
Then Irish fire its heat may show
'Gainst Scottish mettle.

'I fear, my freen', yer fire will chill,
Beneath the sweat in many a rill
That pumping hard will sure distill
From your interior;
No scorching boasts will place fulfill
Of grit* inferior.

'You lead our craft in rhyming art,
And there you've played the master part,
But when with byke you'd hold the start,
An' fain wad keep it,
We'll prove that you from skin to heart
Are too conceited.

'Now, by my slick Columbia's chain,
In Dixon's grapholita lain,
I'll race you like a railroad train,
For mine's a dandy.
You'll rue your challenge ower again,
My valiant Shandy.'

"The 'grapholita' in the second line of the last stanza refers to 'grapholita,' a form of chain lubricant manufactured by the Joseph Dixon Crucible Company. Canny business instincts and metrical requirements met, tied the game and compromised."

Mr. A. M. Castle, No. 9 South Canal street, Chicago, Ill., has been appointed Western sales agent of the Oval Brake Beam Co., of Philadelphia, and will be pleased to give any information that is desired relative to the merits of the beam which he is handling.

* An allusion to oatmeal "grits."

Burst Tire on Locomotive.

Since the introduction of steel tires, little or nothing has been heard of their bursting, although this kind of a frolic was all too common in the old days of chilled tires. Rather a peculiar case happened in New Jersey the other day, when a tire burst with an engine running fifty miles an hour, and the flying pieces made things lively for a few seconds, one piece taking a trip into the side of a car; but no one was killed, although several were pretty well shaken up.

The catalog of machine tools for 1898 issued by the Hilles & Jones Company, Wilmington, Del., is one of their best efforts among a long series of good ones. It is 9 x 12 inches, and shows and describes their punches, shears, rolls and straighteners and plate planers, in elegant examples of the engraver's art, on the best quality of paper. The output of this firm is so well known to users of their line of tools that any reference to their capacity and fitness for any kind of plate manipulation would be superfluous. Their early appearance on the ground with descriptive matter of their products, shows that the old-time push of the management does not stale as the years roll by.

The H. W. Johns Manufacturing Company, New York, are out with a railroad edition, 3½ x 6 inches, of "Vulcabeston for Mechanical and Steam Uses." The purposes for which this material is intended to be used, and also the constituents of it, are plainly set forth in an interesting manner—one of the secrets of good advertising. All its uses as an insulating material, packing and gaskets, are well brought out. The popularity of this material for packing is shown by a wide range of testimonials from railroads, the United States Navy and the air-brake manufacturers, showing the rapidity with which it has reached a front rank.

The Nicholson File Company, of Providence, R. I., have favored their trade friends with a most original and tasteful New Year's greeting. It is in the form of an old English parchment sheet, engraved in old-time lettering with appropriate well-wishes, both the engraving and wording being after the manner of ancient court documents. At the bottom appears President Nicholson's signature, with a crude, old-fashioned red seal stamped beside it. The whole is in keeping with the high standard set by this concern in everything they undertake.

The Lunkenheimer Company, of Cincinnati, O., have engaged the services of Mr. P. F. Leach and W. M. Simpson as their railroad representatives. These gentlemen will form their business under the name of Leach & Simpson. They are both well known to the railroad trade, having had several years' experience in it, and will make special efforts to introduce the Lunkenheimer locomotive specialties, which include injectors, valves, lubricators, whistles and pop valves.

The popularity of reclining chairs is attested by the increased travel on lines where they are a feature of the passenger equipment. They fill the soul of the traveler with a feeling of contentment unknown by the occupant of the old straight-backs, and now that they have made their appearance on a few long runs, after a hot fight for life waged against them by opposing interests, we may properly look for them soon as a regular fixture on the big lines.

The Atchison, Topeka & Santa Fé Railroad Company have commenced work on the completion of their machine shops at Ft. Madison, Ia. These shops were erected with the intention of making them first class in every particular and having the greater part of the locomotive repairs done there. Hard times brought the work to a premature end, and the purpose of the company now is to finish the original plans.

The International Correspondence School, of Scranton, Pa., has made a new departure in furnishing bound volumes of the instruction and question papers, drawings, plates, etc., used in teaching, to all students as soon as they pay the second instalment. Railroad men wishing to obtain a good engineering education at little cost, ought to put themselves in correspondence with this school.

The Joseph Dixon Crucible Co. are pleased with the business of last year, and through their president say: "We have shared the general prosperity. The year has been an agreeable one, the future looks rosy to those who have eyes to see. Perhaps the outlook was never more inviting. Never were there so many roads open to wealth to those who know how to find them."

A very neat calendar has reached us with the prominent device "Savogran" on the top. It comes from the India Alkali Works, Boston. The calendar also shows a medal for highest honors obtained by the company at the World's Fair.

The Baldwin Locomotive works recently had inquiries for locomotives from Finland, Japan, Brazil and Canada at about the same time, showing how widely and effectively the American locomotive is becoming known in the world.

Valve and Cylinder Lubrication.

The following is from the "Railway and Engineering Review": "There has been for the past year an increasing interest displayed in the subject of locomotive valve and cylinder lubrication. It is probable that the conditions obtaining at the present time, and now receiving serious attention from superintendents of motive power, have existed at all times since the introduction of the sight-feed lubricator, and have been the cause of incalculable loss of power by restriction, aside from the ultimate loss effected by undue friction of partially dry motion parts." The need has also been clearly shown by better and more thorough cylinder lubrication at whatever pressure of steam in chests. It is well known that in the compound engines with widely varying pressures, there is an equally great difference in degrees of lubrication. It is readily seen that an oil every way suitable for one cylinder, is almost useless for a cylinder subjected to a higher or lower pressure. A large factory plant can readily carry and make use of different oils according to the varying requirements, and does so with most economical results. This cannot be done on a locomotive. It would therefore seem that the successful use of pure flake graphite by hundreds of locomotive engineers is worthy of the prompt and careful attention of all superintendents of motive power, and by traveling engineers as well.

Pure graphite is practically indestructible, therefore successfully resists the action of all the causes that so completely destroy all lubricating oils. Graphite has a strong affinity for metals, and readily attaches itself and holds to all bearing parts, and forming a surface of remarkable smoothness and endurance.

There is much misapprehension as to what lubrication really is. Professors Thurston, Denton, Stillman and others have demonstrated for us that friction is the resistance of the microscopic irregularities of surface to removal, and the heat engendered represents the work done in overcoming this resistance. That is friction, and to prevent this waste of energy and the wear of parts, and to enable the locomotive to do its work, an oil lubricant is introduced. The oil, by filling up the inequalities of the bearing surfaces with its globules, lifts the opposing surfaces above the irregularities and forms a new surface, consisting practically of an innumerable series of microscopic but perfect "ball bearings." Oil lubricants, however, are subjected not only to the destructive influences of water, heat and superheated steam, but also to what is known as "fluid friction," explained by Grossman, who says: "Different parts of the same lubricating layer, moving at different speeds, produce relative movements, which result in friction in the lubricant itself."

Graphite has not been successfully introduced by many engineers through the sight-feed lubricators. A much better way is to introduce it through the relief valves, and in this way it has been most successfully used. The Dixon Crucible Company, Jersey City, N. J., send, free of charge, some very interesting pamphlets on the subject of graphite lubrication.

American Pumps Help a Big Line.

In connection with the high speed attained by the great North-German Lloyd steamer Kaiser Wilhelm der Grosse, it is gratifying to note that the great speed attained was due in a measure to the use of American machinery, and it is significant that the lines of the record-breaker are closely similar to those of American vessels. The condenser air pumps, as also the outfit of auxiliary feed, fire and bilge pumps, are of American (Blake) design and manufacture, similar to those in use in the United States Navy. These air pumps are independent of the main engines, and operate, according to official government reports made on trials of American war vessels, with an expenditure of only one-sixth of 1 per cent. of the total engine power. It is estimated by naval engineers that the Kaiser Wilhelm will soon beat the record of the Lucania on a consumption of 50 tons less of coal per day.

The same (Blake) system of independent air pumps has been adopted by the German Navy for the imperial cruiser Hildebrand, and also by the Austrian and Spanish Governments for some of their modern torpedo boats and gun boats. Its adoption by the builders of the Kaiser Wilhelm is directly traced by the American manufacturers to a visit paid by the German Emperor and his staff of engineer officers to the United States cruiser New York at the time of the Kiel celebration, some three years ago.

The most important market for British locomotives in 1897 was that of India. The State railways were not large customers, being responsible for somewhere about forty engines only, which is a small proportion, considering the mileage of lines coming under this category. The East India Company, however, took seventy-seven engines; the Bombay & Baroda Company, forty engines, and the Great Indian Peninsula, twenty-five. These, with sundry small orders, brought India well to the front in the British trade in locomotives.

According to the *Railroad Gazette*, the locomotive shops, other than railroad shops, built 1,251 locomotives in 1897, as compared with 1,176 in the previous year and 1,101 in 1895. Of the locomotives built in the year just closed, 386 were for export; in the preceding year 309 were for export. The number of freight cars built during the year 1897 was 43,588, as compared with 51,189 in the preceding year and 38,100 in 1895. The same companies built 494 passenger cars, twenty more than in 1896.

The Pennsylvania road made a speed record between the Allegheny Mountains and the Mississippi River, on January 18th, when engine 1504 hauled eight heavy cars 55 miles in 47 minutes, actual running time, which is at the rate of over 70 miles an hour. This is not so bad, when the size of train is considered. This engine is not as heavy as the class "L" engines, and has a smaller cylinder, but carries a higher boiler pressure.

The Sessions Foundry Company, of Bristol, Conn., have undertaken the manufacture of the Whitcomb brake shoe, which has a number of cork inserts on the face. We understand that the Boston & Maine, the New England Railroad and several others have trains equipped with this shoe, and that it is giving entire satisfaction. Any person wishing to get further particulars about the shoe should apply to the president, Mr. W. W. Whitcomb, 620 Atlantic avenue, Boston, Mass.

The J. G. Brill Co., Philadelphia, have published an illustrated pamphlet showing their three-spring electric truck, which is famous for its smooth riding qualities and is well adapted for steam railroad conditions. The pamphlet contains some testimonials from railroad men using the truck that praise it very highly. It ought to be read by every man in charge of railroad rolling stock.

Our friends have been very liberal in sending us calendars for the coming year, and some of them are of very artistic character. At the head of these we would like to mention that sent out by the Pratt & Whitney Co., of Hartford, Conn., which gives us separate slips for each month of the year, suitable for being put in a frame which the company sent us last year.

It is stated on what is called good authority, that the Lake Shore contemplates the erection of additional repair shops at Dunkirk, owing to the increased business at that end of the line, and partly to the crowded condition of the company's shops in East Buffalo. The company own valuable land at Dunkirk.

G. W. Hoffman, of Indianapolis, reports that his business of selling metal polish to railroad men is in a very flourishing condition. His export trade is increasing very rapidly.

The New York office of the Cooke Locomotive and Machine Co. has been moved from 45 Broadway to 916 Havemeyer Building.

W. D. Forbes & Co., Hoboken, N. J., announce that Mr. Norman St. G. Campbell has retired from the firm by mutual agreement.

The Baltimore & Ohio Railroad is now reaping the benefits of the improvements that have been made to the property since John K. Cowen and Oscar G. Murray were appointed receivers. It was stated by a noted critic of railway operations, a few months ago, that if the receivers succeeded in increasing the train haul per mile to 300, that they could be commended for having spent so much money in buying new locomotives, straightening curves, lowering grades and laying new rail. Since June 30th a careful record has been kept, and the results have been more than gratifying to the management. Before new locomotives were purchased, before track improvements were made and before the tonnage system of loading trains was adopted, the average train haul per ton per mile on the Baltimore & Ohio Railroad was less than 225 tons, and some old employés think it did not exceed 200 tons. There are no figures for comparison; but in July the average was 334.76; in August, 356.41, and in September, 361.4, a very large and satisfactory increase. The average would have been still larger, but for the fact that on several divisions, depending on coal for tonnage, but little or none was moved, owing to the strike.

During the month, we have recived from the Q. & C. Company of Chicago, two handsomely illustrated catalogs, one showing all particulars about the Scott boiler feeder and the other showing the company's railway specialties. The Boiler Feeder Catalog is very comprehensive and gives a great deal of valuable information relating to steam engineering. Every man who has charge of steam boilers would find this catalog a very useful reference to have on his desk. The Railway Specialties Catalog shows the Priest snow flanger at work, which is a very seasonable illustration for this time of the year. It shows the various jacks made by the company, the McKee slack adjuster, pressed steel journal box lids, and, in fact, all the varied appliances for railroad work handled by the company. Both of the catalogs are gotten up in first-class style and are of the standard size, the same as Locomotive Engineering.

Engineer James McCullough and Conductor William Conley, of the Pittsburg division, and Engineer William Gloyd and Conductor J. H. Cochran, of the Columbus division of the Panhandle, have been requested to appear at the next meeting of the trainmasters and dispatchers, which is to be held in Columbus on the first Tuesday in February. The trainmen and engineers will be asked for information regarding the handling and moving of through and local trains, and the causes of delay, and the best methods of obviating such troubles. They will be asked particularly to give their views on the best manner of avoiding delays to fast trains. This is a good plan, as the ideas of practical men who have had experience with heavy trains on the road will be of great value in the convention.

The Davis & Egan Machine Tool Company, of Cincinnati, O., again find it necessary to increase their capacity, owing to their growing foreign and domestic trade. They have secured the plant formerly occupied by the Walton Iron Company, located in Covington, Ky. The building is 300 feet long by 100 feet wide, and, with adjoining ground, occupies an entire block. It is of modern construction, and will be equipped with electric traveling crane, electric generators, air hoists, hot-air system and all modern appliances. This new plant will simply be an addition to their Cincinnati works, and will be used for the manufacture of large lathes, planers and boring mills. It is located on the Chesapeake & Ohio Railroad, with tracks running into it affording excellent shipping facilities.

The Jones & Lamson Machine Company have issued a new catalog, 6 x 9 inches, for 1898, in which they show up the errors of screw cutting by the old methods, and dilate interestingly on the way they have eliminated errors of pitch in their thread-cutting machines. The written description explains all about the Hartness automatic die and how they are made, supplemented by the finest of half-tone engravings. The talks on the errors of taps and how they are overcome are well worth the time of any man that has to use taps or dies in his business. It is an artistic exposé of refined screw cutting, and should be in every catalog file.

A modest little white folding pasteboard card, having no device on the outer face, except the cut of a mail-bag, inscribed "The Lake Shore & Michigan Southern Railway," and the compliments of the season happily expressed on the inside, over the signature of E. J. McMahon, manager of the advertising department, apprises us of the fact that the Lake Shore is going to do business at the old stand during 1898.

Mr. Geo. A. Zeller, of 18 South Fourth street, St. Louis, Mo., is sending out a little pamphlet concerning "Stromberg's Steam Users' Guide," which gives a good idea of the scope of the book. A large number of interesting questions are asked which will put any man to quite a test to answer. The book, we believe, answers them all.

LOCOMOTIVE ENGINEERING
A PRACTICAL JOURNAL of RAILWAY MOTIVE POWER AND ROLLING STOCK.
[Trade-Mark Registered.]
Vol. XI. NEW YORK, MARCH, 1898. No. 3.

Susquehanna Connecting Railroad Passenger Engine.

In reading the history of counties, we generally find that careful mention is made of the first white child born in the district from which the county was formed. The descendants of the child often make him or her the fountain-head of a proud pedigree.

That may seem to be an odd beginning of a description of a locomotive, but nevertheless it is quite proper in this case, for the engine hereby shown enjoys the distinction of being the first locomotive built in Monroe County, Pa., and the people in that region look with much pride and affection upon the engine.

The engine, however, deserves attention apart from pride of locality. It was built at the Stroudsburg shops of the Wilkes-Barre & Eastern Railroad for the Susquehanna Connecting Railroad. Mr. W. H. Taylor, master mechanic of the road, is the designer of the engine, and the work was done under the supervision of Mr. John W. Oplinger, general foreman of the shops.

The engine is finely proportioned, has a handsome appearance, and has been put together with great care. The leading dimensions are:

Cylinders—18 x 24 inches.
Steam ports—1⅜ x 18 inches.
Exhaust ports—3 x 18 inches.
Driving wheels, diameter—62 inches.

STROUDSBURG'S FIRST LOCOMOTIVE.

Driving axle journals—8 x 10 inches.
Engine truck jornals—5½ x 10 inches.
Driving wheel base—8 feet 6 inches.
Total wheel base of engine—23 feet.
Boiler, diameter at smallest ring—58 inches.
Boiler pressure—165 pounds.
Firebox—Length, 9 feet 6 inches; width, 7 feet.
Tubes—Number, 204; diameter, 2 inches; length, 12 feet 8 inches.
Grates—Cast iron; four dumps; water bars.
Hight from rail to top of stack—14 feet 6 inches.
Packing—Jerome metallic.
Brakes—Westinghouse; American outside, equalized on drivers.
Train signal—Westinghouse.
Lubricators—Nathan, sight feed.
Injectors—Monitor, No. 9.
Slide valves—Richardson.
Safety valves—3-inch Richardson.
Gages—Crosby.

This engine is now running out from Jersey City, on the N. Y., S. & W. R. R., pulling six coaches on one of the hardest runs. Engine burns pea coal exclusively.

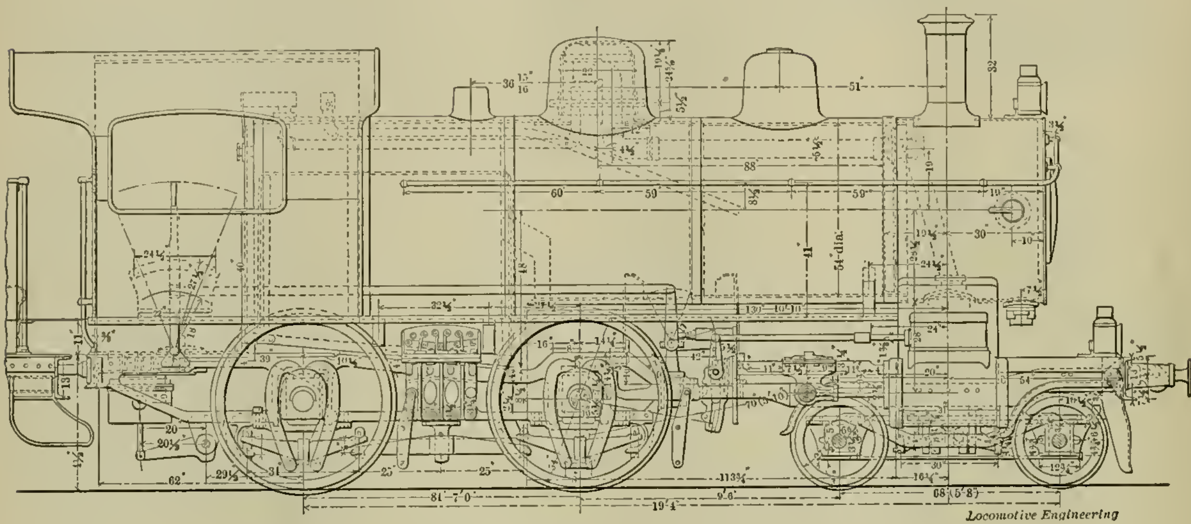
We are indebted to Mr. R. S. Lee, our agent at Stroudsburg, for photograph and particulars about this engine.

The Lake Shore and Michigan Southern Railroad are meeting with a great demand for their "mail-pouch" calendars, which proved so popular last year that they re-issued them for 1898. It is a novel and at the same time a useful calendar.

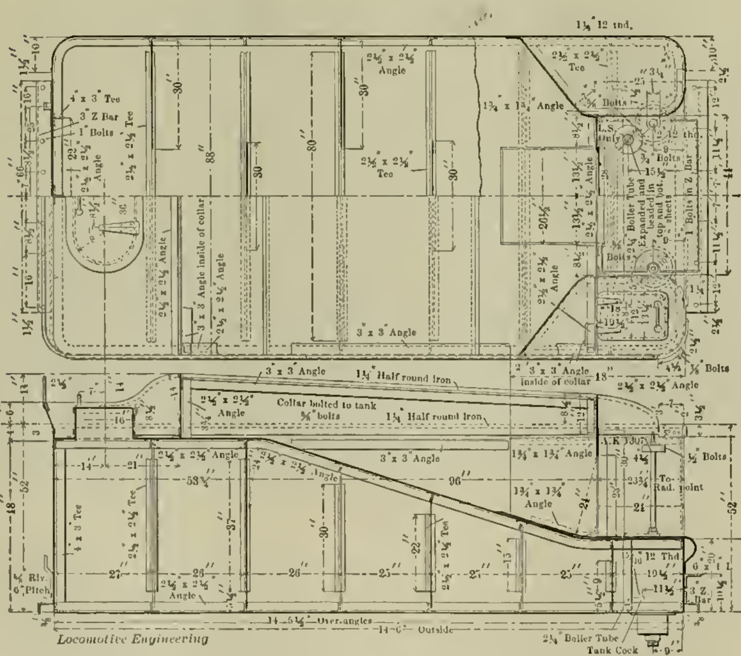
Eight-Wheel Passenger Engine for Japan.

The Brooks Locomotive Works have just completed and shipped an order of twenty eight-wheel passenger engines for the Imperial Government Railways of Japan. These engines, here illustrated, have the peculiarity of very small cylinders, which at this time of heavy power with large cylinders, seems to be, at first sight rather a retrograde move in locomotive design; but a peek at some of the other details to be described shows these machines are not to be placed in the ranks of the puny ones, for they can exert a starting power of 13,300 pounds.

The boiler is of the straight type, with a firebox above the frame, and has a diameter of 54 inches at the front ring. It is a boiler that would be regarded as good practice for a 17-inch engine, and, in fact, few engines with 17-inch cylinders have a boiler as large as this. The tender has a sloping coal space which ends at a hight of 20 inches above the frame and at a point a little above the engine deck. A set of six wheels carries the tender on $4\frac{1}{4}$ x 8-inch journals. Buffers at the rear of tender, on each side, and the front of engine, together with the screw coupling, give a distinctively foreign air to the machine. Some points of interest concerning details will be found below:



BROOKS LOCOMOTIVE FOR JAPAN.



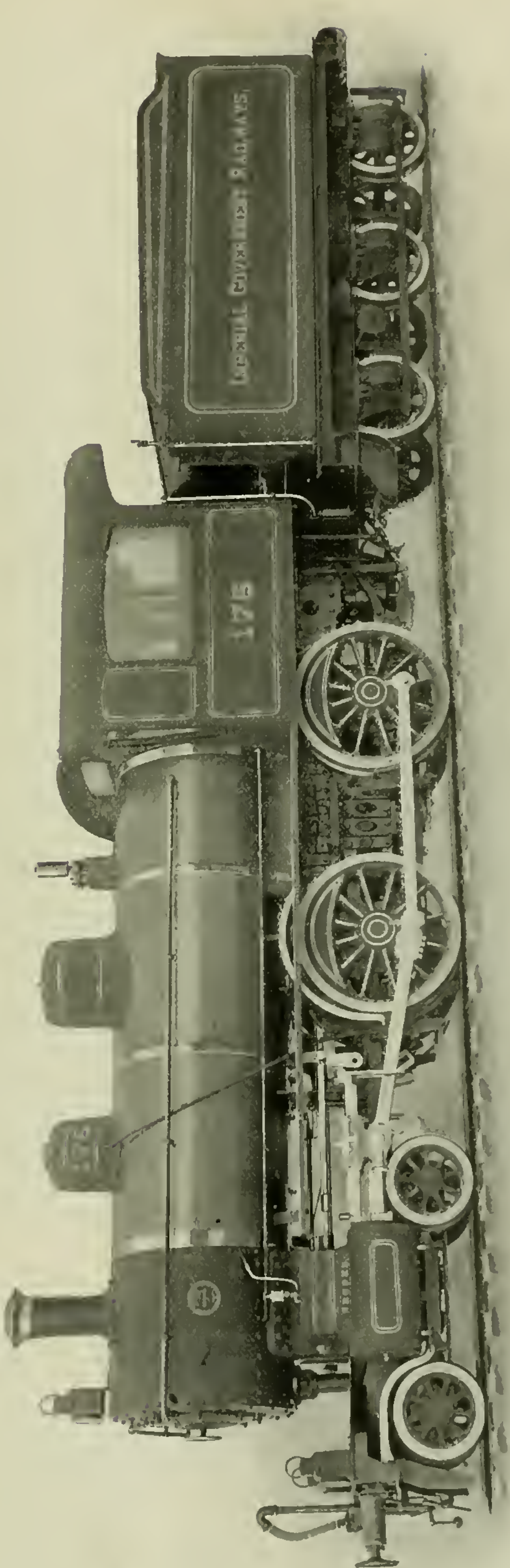
TENDER OF JAPANESE LOCOMOTIVE.

Gage—3 feet 6 inches.
Weight on drivers—50,400 pounds.
Weight on truck—24,100 pounds.
Weight, total—74,500 pounds.
Weight of tender, loaded—52,000 pounds.
Wheel base, total of engine—19 feet 4 inches.
Wheel base, driving wheels—7 feet.
Wheel base, total of engine and tender—38 feet 9 inches.
Length over all, engine—28 feet $3\frac{1}{2}$ inches.
Length over all, engine and tender—46 feet 6 inches.
Hight, center of boiler above rail—7 feet 1 inch.
Hight of stack above rail—12 feet $1\frac{1}{2}$ inches.
Heating surface, firebox—89.9 square feet.
Heating surface, tubes—965 square feet.
Heating surface, total—1,054.9 square feet.
Grate area—15.2 square feet.
Drivers, diameter—54 inches.
Drivers, material of centers—Iron.
Truck wheels, diameter—$27\frac{1}{4}$ inches.
Journals, driving axles—$6\frac{1}{2}$ x 8 inches.
Journals, truck axles—$4\frac{1}{2}$ x 7 inches.
Main crank pin—4 x $4\frac{1}{2}$ inches.
Cylinders, diameter—15 inches.
Pistons, stroke—22 inches.
Piston rod, diameter—$2\frac{7}{8}$ inches.
Piston rod packing—Jerome.
Steam ports, length—14 inches.
Steam ports, width—$1\frac{3}{8}$ inches.
Exhaust ports, length—14 inches.
Exhaust ports, width—$2\frac{1}{2}$ inches.
Bridges, width—$1\frac{3}{8}$ inches.
Valves, kind—Richardson.
Valves, greatest travel—$6\frac{1}{4}$ inches.
Valves, outside lap—1 inch.
Boiler, type—Straight top.

Boiler, working pressure—160 pounds.
Boiler, material in barrel—Steel.
Boiler, thickness of material in barrel—½ inch.
Boiler, thickness of tube sheet—½ inch.
Boiler, diameter of barrel—54 inches.
Seams, kind of horizontal—Quadruple.
Seams, kind of circular—Double.
Crown sheet stays—Radial.
Dome, diameter—22 inches.
Firebox, type—Sloping over frames.
Firebox, length—6 feet 6 inches.
Firebox, width—2 feet 5½ inches.
Firebox, depth at front—59½ inches.
Firebox, depth at back—51½ inches.
Firebox, material—Copper.
Firebox, thickness of sheets, sides, door and crown, ½ inch; tube sheet, ⅞ inch.
Firebox, mud-ring, width—Front, 3½ inches; sides, 2½ inches; back, 3 inches.
Water space at top—Front, 3½ inches; sides, 5 inches; back, 4 inches.
Tubes, number—210.
Tubes, material—Solid drawn brass.
Tubes, outside diameter—1¾ inches.
Tubes, length over sheets—9 feet 7 1-16 inches.
Exhaust nozzle, diameter—4, 4 3-16 and 4⅜ inches.
Tender, type—Six-wheeled, rigid pedestal, with sloping flat top.
Tank, capacity for water—2,400 gallons.
Tank, coal capacity—5 tons.
Tender, diameter of wheels—36 inches.
Diameter and length of tender journals —4¼ x 8 inches.
Engine provided with: Three headlights, with 8-inch semaphore lens; Smith's automatic vacuum brake on all drivers and on tender; one Detroit No. 2 double sight-feed lubricator; ¾-pint Detroit lubricators on steam chests; two Kunkle 2½-inch safety valves.

New Boiler Shops for Dickson Locomotive Works.

The Dickson Locomotive Works, of Scranton, Pa., have recently put up a fine new boiler shop, in which they have excellent facilities for turning out first-class boiler work. They have a powerful hydraulic riveting machine, capable of giving a pressure of 150 tons, and with a range in work that makes it possible to reach all parts of the boiler. They have bending rolls which will bend sheets 16 feet long and 1¼ inches thick. They have a machine for drilling all flue plates and a large plate edge planer. Their new furnaces are of such capacity that the largest sheets can be heated at one time, and all injury caused by heating in sections is thus avoided. All flanging of boiler plates is done by hydraulic machinery. By the use of large special shell drills, connecting sheets, when fitted up, are drilled and reamed in place, by which means the holes are seen to be in line and the danger of injury by punching is avoided. Compressed air tools are used in caulking, drilling, reaming and beading tubes.



BROOKS JAPANESE LOCOMOTIVE.

Electric Motors.

We are continually being asked about electric motors and electricity for railroads, which shows a healthy desire on the part of many railroad men to know more about things generally, and we shall endeavor to give, in as plain language as possible, some of the leading points regarding electricity as well as electric motors and their application to railroad work. They will not be technical, but rather in a popular vein and easily understood.

The first question usually asked is: What is electricity? We don't know, and have the satisfaction, in our ignorance, of knowing that nobody else does either.

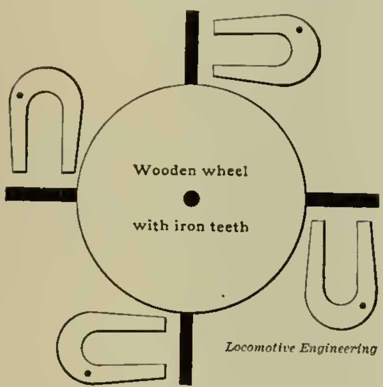


Fig. 1

PRIMITIVE MOTOR.

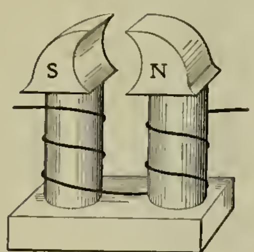


Fig. 2

ELECTRO-MAGNET.

There are several pretty theories which can be made to fit the facts of the case with variations and changes, but every honest electrician, from Prof. Elihu Thompson down to the revolutionizers, will tell you they don't know. We know pretty well what it does, and fairly well how to control it; so what it really is does not matter so much.

Everyone is familiar with a horseshoe magnet and a compass. If not, get one of each for a little quiet experimenting. They will only cost a few cents and are the foundations of electricity as applied to motors and other electrical machinery.

The horseshoe magnet is a piece of steel, hardened at the ends after being bent into a horseshoe and then magnetized. This is done by passing an electric current around it, either from a battery or from a dynamo, or by rubbing it on another magnet in the right way, or by holding it near the "fields" of a dynamo so as to have some of the magnetism ("magnetic lines of force," the electricians call it) pass through it.

We know from simple experiments with the magnet that it exerts an attractive power over a piece of iron or steel (which are magnetic metals), and if the piece is not too heavy it will lift it in the air a short distance to the magnet. It is on this principle that all motors operate; the revolving portion or armature (in most cases) is attracted by the magnetism of the stationary part or fields, and by a little ingenious mechanism the attraction is made constant so as to produce a constant revolution of the armature, and any desired work is done by attaching it to the armature shaft, either direct or by gearing of any kind.

The horseshoe magnet is a permanent magnet, so called because it retains its magnetism a long time (although it is not, strictly speaking, permanent), but it is seldom used except for minor purposes, for the reason that much more powerful and economical results can be obtained from electro-magnets, which are simply soft iron pieces or cores, surrounded by insulated wire carrying an electric current. These are only active while an electric current is passing through the wire, although there is a trace of residual or resident magnetism in nearly all cases.

Suppose we take four horseshoe magnets and fasten them as shown in Fig. 1. Inside this ring of magnets we mount a wheel of wood with four iron projections, as shown. We also put a fly-wheel on the shaft to help it over the centers.

In the position shown the magnet would pull or attract the iron pieces until they reached the magnets. If then the magnets were suddenly lifted out of the way until the iron pieces had passed them and then dropped down once more in time to pull again at the next tooth or teeth, a continuous motion would result. This is, of course, an impracticable device, and is only shown to impress the idea that it is magnetic attraction which is at the foundation of all electric motors in use to-day.

If instead of using these horseshoe magnets we take an iron forging or casting, as shown in Fig. 2, and wind it with insulated wire so as to enable an electric current to flow round it, we shall have a close resemblance to the average motor or dynamo, and this forms in reality a large and powerful horseshoe magnet of a modified form. One end (or pole) will be north (that is, will attract the south end of a compass needle), and the other south, and a few experiments with a compass and magnet will show, like poles repel each other, while unlike poles attract. This is the basis of the action of a motor.

Now leaving the motor for a glance at the dynamo (in reality they are practically the same machine); or perhaps it would be better to say, let us consider the motor as being driven by an outside power, so as to make it a dynamo. This is really the only difference between the two. If you drive a motor by a steam engine it will become a dynamo and generate current; while if you supply electric current to a dynamo, it will run as a motor. Let us see why, as nearly as we can.

It has been found that if a wire is moved between the poles of a magnet (between which the magnetic lines of force are supposed to be flowing), a current of electricity will flow in the wire. Never mind why it does—suffice to say, it does. The rate and quantity of this flow depends upon the strength of the magnet, the number of wires and the number of times per minute they pass through (or cut) the magnetic lines.

The moving wires form what is called the armature, which usually has a soft iron core over which the wire is wound, the iron forming an easy path for the flow of magnetic lines.

These wires passing through or cutting the magnetic lines of force produce, or have generated, an electric current in them, which flows out through the medium of the commutator, as the collection of copper strips on which the brushes rest is called.

Reversing this process and sending an electric current into the wires of the armature, forms or creates North and South poles in the armature, which are attracted by (and also attract) the poles of the magnet (or field), and the armature revolves. It would stop, however, when the North pole of the magnet and South pole of the armature were together, if the current was not continually switched by the commutator into different sets of wires on the armature, so as to always make an attraction between armature and motor, just as between our horse-shoe magnets and the iron toothed wheel in Fig. 1.

In brief, and without going into many details, this is why an electric motor "motes."

There are still many points regarding its construction and application to railroad work, which will be explained later, if enough of the readers desire to have them. If you want another dose of electricity, say so, and it will be forthcoming.

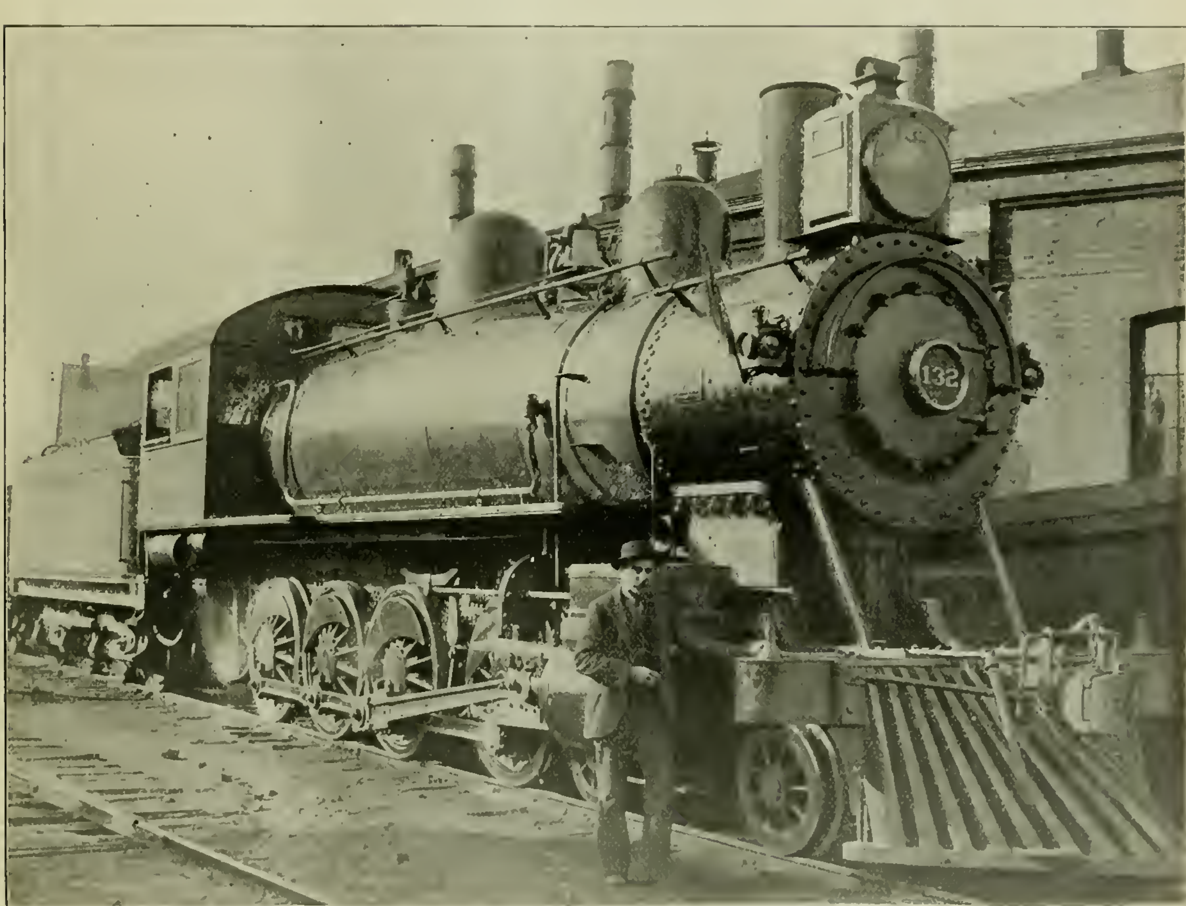
There has been for several years discussion going on in the Traveling Engineers' Association concerning the best time of the year to hold the conventions. The practice has been to meet in September, but some of the members thought it would be better to meet earlier in the year. To settle the matter, a letter ballot was recently taken, and the majority voted in favor of continuing to meet in September.

Twelve-Wheel Locomotive — Chicago & Eastern Illinois Railroad.

The Pittsburgh Locomotive Works have recently built some engines of the "Mastodon" type for the Chicago & Eastern Illinois Railroad. These engines we illustrate, with a half-tone and a side elevation giving the general dimensions from which, in connection with the written particulars, the most interesting points of the machine may be gathered.

The reason for the use of this heavy type of engine on a road free from what our foreign friends call "banks," is, as we are informed by Superintendent of Machinery T. A. Lawes, because it is not possible with the other power on the road, to haul the same loads in winter as in summer. The large consolidation engines are rated at forty-seven loads in summer and 35 in winter. The new twelve-wheelers will take fifty cars in winter, and at this time are hauling fifty-six loads on a grade 21 feet per mile. Their performance is more than equal to expectations. The coal used on these engines is what is known as "run of the mine," and this will explain the large grate area of 35.7 square feet.

Advantage has been taken of weak points developed by the older engines in hauling heavy freight trains, and in the new power the frames have been made extra heavy, and the cylinders reinforced at places known to be weak. All driving wheels are equalized together, and at the rear pair the equalizer engages with a double elliptic spring. The crosshead is of the central draft kind with the two-bar guide. The front end will require an elastic imagination to call it extended, and shows by its reasonable proportions a return to rational practice. The crown sheet is supported by radial stays 1¼ inches in diameter, except the three front rows, which are sling stays. A general description is given below:



CHICAGO & EASTERN ILLINOIS TWELVE-WHEELER.

Fuel—Bituminous coal.

Driving wheel base—15 feet 6 inches.

Total wheel base—25 feet 4 inches.

Total wheel base of engine and tender—53 feet 7 inches.

Weight on drivers in working order—142,000 pounds.

Total weight—172,000 pounds.

Cylinders—21 inches diameter, 26 inches stroke.

Driving wheels—54 inches diameter.

Main driving wheel centers—Cast steel.

Boiler of Illinois Steel Company's steel.

All horizontal seams with butt joints, sextuple riveted and welt strips inside.

Barrel of boiler—9-16 inch; dome, ⅝ inch thick.

Outside firebox shell—11-16 inch thick.

Diameter of waist at small ring—64 inches outside.

Working boiler pressure—200 pounds.

Firebox, length inside—126 inches.

Firebox, width inside—41 inches.

Crown sheet—7-16 inch thick.

Tube sheet—½ inch thick.

Side and back sheets—⅜ inch thick.

Water spaces—3½ inches sides and back, 4 inches front.

Firebox ring—Double riveted.

Staybolts—1 inch diameter, with hole 3-16 inch diameter drilled 1¼ inches deep in outer end only.

Tubes of charcoal iron, No. 12 W. G.

Tubes, number—296.

Tubes, diameter outside—2 inches.

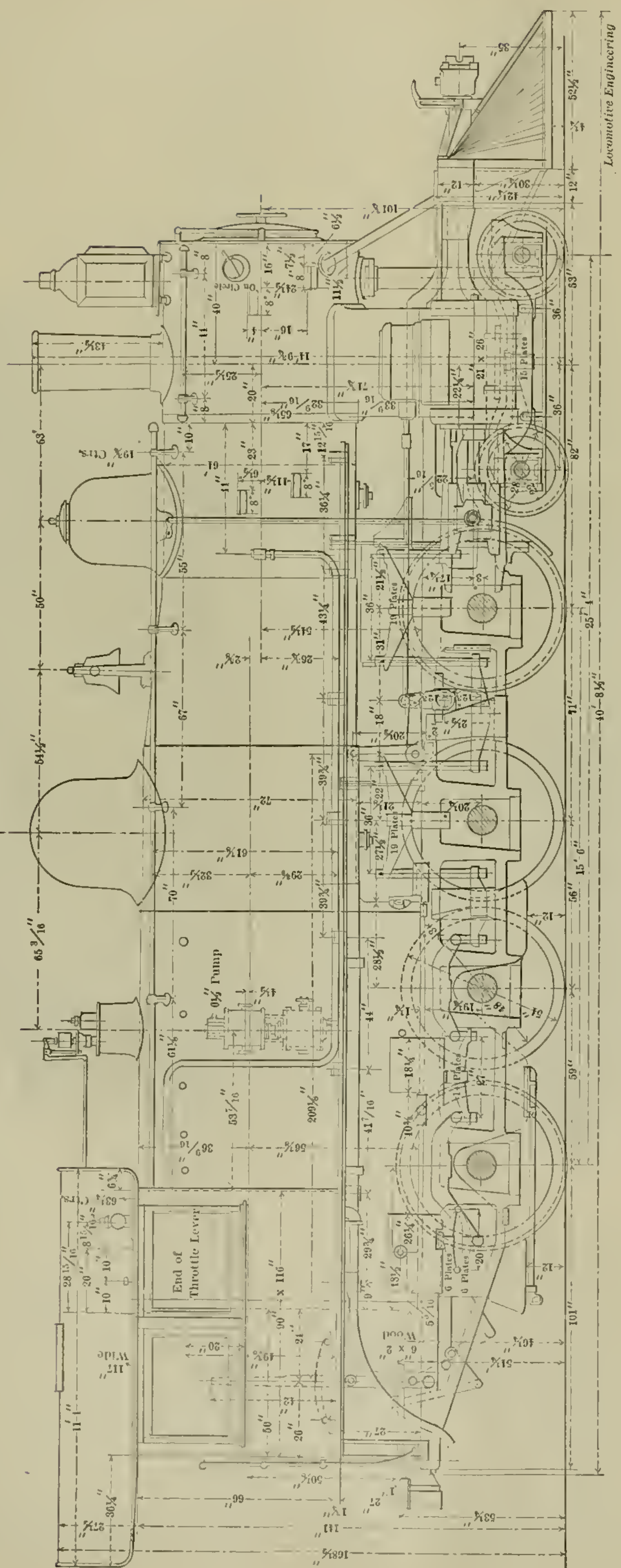
Tubes, length—13 feet 6 inches, with copper ferrules at back end.

Grates—Rocking.

Frames—4½ inches wide throughout.

Piston packing—Dunbar.

Piston rods—Cambria steel, "Coffin process," 4 inches diameter.



CHICAGO & EASTERN ILLINOIS TWELVE-WHEELER.

U. S. packing on piston rods and valve stems.

Slide valves—"American" balanced.

Guides of hammered iron.

Driving axles—Cambria steel, "Coffin process."

Driving axle journals—8½ inches diameter, 10 inches long.

Driving axle bearings—Magnus metal.

Springs—A. French Company.

Rods of hammered steel, I-section.

Parallel rods with solid ends.

Rod bearings of Magnus metal.

Rod cups forged on.

Crank pins—Cambria steel, "Coffin process."

Injectors—Two Nathan, No. 10.

Firebox heating surface—197 square feet.

Tube heating surface, external—2,102 square feet.

Total heating surface—2,299 square feet.

Grate area—35.7 square feet.

Engine truck wheels—28 inches diameter, steel tired.

Engine truck axles—Hammered steel.

Engine truck axle journals—5 x 10 inches.

Cab of steel.

Drawheads, front and back—Tower automatic coupler.

Lagging—Magnesia sectional on boiler, dome and boiler head.

Boiler front and door—Hydraulic pressed steel.

Sanding apparatus—Leach.

Bell-ringer—Cooke & Strong.

Tender frame—10-inch channel steel.

Tender truck—Four-wheeled, center.

Bearing—Fox Pressed Steel Company.

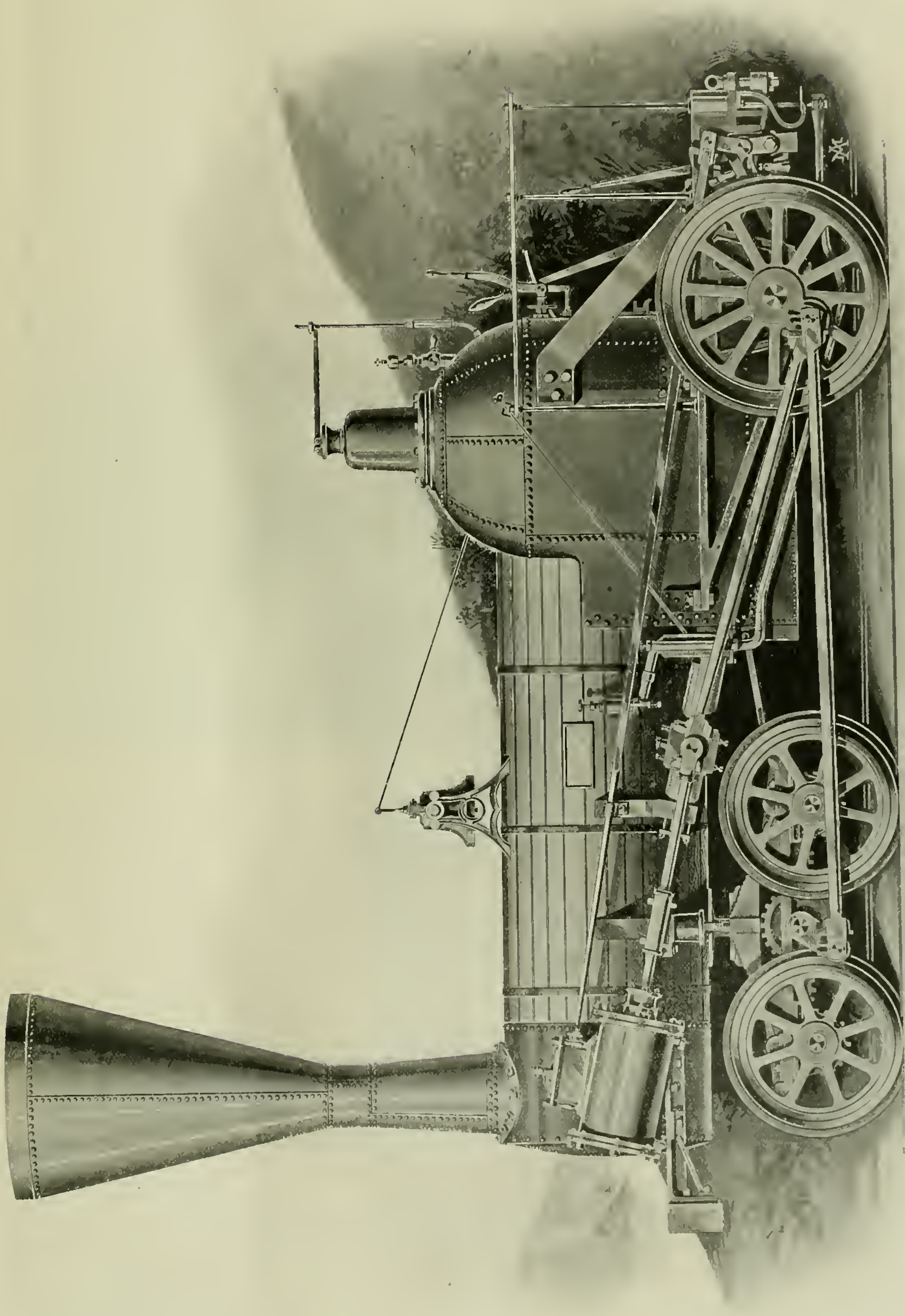
Tender wheels—33-inch cast iron.

Tender axles—Hammered steel, M. C. B. standard, 5 x 9 inch journals.

Tank capacity—4,000 gallons.

Brake—Westinghouse and American, combined; brakes on all drivers, tender, and for train, 9½-inch air pump.

The Indianapolis *Journal* says: The closer relations being established between the Cincinnati, Hamilton & Dayton and the Indianapolis, Decatur & Western and the purchase by each of the roads of 1,000 new cars makes it evident that the Indianapolis division of the Cincinnati, Hamilton & Dayton is to become a more important line to the system through its connection with the Indianapolis, Decatur & Western, as neither the Cincinnati, Hamilton & Dayton nor the Indianapolis, Decatur & Western for the last two years has been able to supply orders for cars which legitimately belongs to the two roads, having to depend too much on connections and fast freight lines to help them out in the matter of cars. With these new cars the Cincinnati, Hamilton & Dayton will be one of the best equipped per mile of any of the roads in this section.



FADS AND FANCIES IN LOCOMOTIVE BUILDING—No. 3.

AN EARLY BALDWIN ENGINE, 1841.

Fads and Fancies in Locomotive Building—No. 3.

In about 1838 and 1839 the question of more powerful engines came to the front, and eight-wheel engines were just coming into use when Matthew Baldwin, who opposed the eight-wheel plan on the ground of having too many parts and the difficulty of keeping the drivers of exactly the same size—more adhesion being necessary than could be obtained with his early engines—devised the plan shown in chart No. 3, and was granted a patent on it December 31, 1840.

An independent shaft was placed between the truck axles and connected by cranks and the long side rod to the main drivers. The shaft carried a central cog wheel which drove each truck axle, through intermediate gearing; the intermediate gears having wide teeth, so the truck could pivot while the central shaft remained parallel with the driving axle. These gears were of such diameter as to drive the truck wheels at the same surface speed as the drivers; but it is rather amusing to think of this feature, after the inventor's objection to any slight difference in diameters of drivers, for the gearing (of that day in particular) is much more apt to cause trouble than the other.

This engine was built in 1841, and in August of that year was put into service by the Sugarloaf Coal Company. It weighed 30,000 pounds, with 11,775 pounds on the drivers, and the balance on the truck. The drivers were 44 inches and the truck wheels 33 inches in diameter, while the cylinders were 13 inches diameter by 16 inches stroke.

On the trial trip it hauled 590 tons from Reading to Philadelphia (54 miles) in 5 hours and 22 minutes, and was highly commended by many; but in spite of this and the most sanguine hopes of Mr. Baldwin, there was no demand for these engines, and this was the only one built.

In this connection it is interesting to note some of the claims of the patent referred to. There were: A fan for blowing the fire, placed under the foot-board and driven by friction of grooved wheel on driver flange (we didn't dream of infringing this when we designed the Gilderfluke grate-shaker); metallic packing, of wire, instead of hemp or wool, for stuffing boxes; spiral and semi-elliptic springs at each end of truck frame, and several other interesting points.

This engine is one of the many steps in locomotive development, and as it is not generally known, is sure to be of interest.

BOY'S LOCOMOTIVE THAT GOES.

A Boy's Engine That Goes.

One of the builders, Edwin Warner, of Woburn, Mass., writes:

"We began to build the engine in the cellar of the house, in January, 1897. The pipe was cut and fitted, and the various parts were put together. The boiler was raised on jack-screws to the desired hight, and then blocked until the legs were put under. By July the machine became so large that we had to leave it for a time, and build a house for it in the yard. When the house was completed, we took the machine apart and carried the pieces out and again put them together.

"The first trial was made late in August, and from that time it was used until November 25th, when it was put up for the winter.

"The boiler is 3 feet long, and the smoke-box 3 feet, making the iron work of the engine 6 feet long. The boiler is 2 feet in diameter and has thirty-five 1¾-inch tubes. The firebox is about 15 inches square, and is lined with fire bricks. We use soft coal for fuel, and have a steam pipe in the smoke-stack for a blower. The boiler will stand 100 pounds pressure, but we use but 45.

"The engine is six horse-power and takes ¾-inch pipe. It has two oscillating cylinders, each 3½ inches in diameter. The engine is reversed by means of four valves, which are worked with one lever in the cab. The wheels of the locomotive are 30 inches in diameter, and the shafts are 2 inches. We had pulleys for wheels at the time this picture was taken, but the machine proved to be too heavy for them, and we had to get some car wheels, weighing 175 pounds each. The engine weighs about 4,000 pounds.

"The cab is 4½ feet wide, and about the same length. Hight from ground to top of cab is 8 feet; to top of boiler is 6 feet. There are two seats, one on each side of the cab. The inside of the cab is arranged like a large engine, having a throttle and reverse lever (from a railroad engine), steam gage, lubricator, gong, injector, try-cocks, water column, whistle lever, fire-door and lights for the gages.

"Everything about the engine works perfectly. Its length is 12 feet; the gage of the track is 3½ feet. We have ridden about seventy-five miles over the 120-foot track, going over it about 4,000 times. Our rails are wood, with heavy strap iron on them. There is a large oak tree at the end of the track, serving as a bumper. We are near the railroad, and the trains pass often. We whistle to the engineers, who wave back to us.

"As we go to school, Saturday is our day to run it, and then it was not uncommon to see three or four teams and a line of bicycles by the fence, and many men, women and children in the yard. Next summer we intend to extend the track, in another direction.

"We had a sample copy of your paper at the time we were building the engine, and I read it through two or three times, and found many helps in it."

Delay Caused by the Governor.

A bright Western master mechanic was riding on the engine of a passenger train when his hat blew off. The train, not being fast or important, was stopped and backed up to recover the article required to re-cover the shiny bald spot. The train being over the limit of three minutes late at the next station, the train despatcher inquired the cause of the delay. "What shall I say?" asked the engineer of his master mechanic. "Tell him," replied the witty M. M., "that the cap blew off the governor."

It is needless to say that the officious T. D. was satisfied, and the week's report showed an engine failure due to the cause reported.

Practical Letters from Practical Men.

All letters in this Department must have name of author attached.

Central American News.

Editors:

Believing that your readers might like to hear from an American in this section of Central America, I have been led to write you as follows:

The Ferrocarril of Acajutla & Santa Ana, in the Republic of Salvadore, the road on which I am employed, has about 120 miles of track, and is equipped with cars of both English and American build.

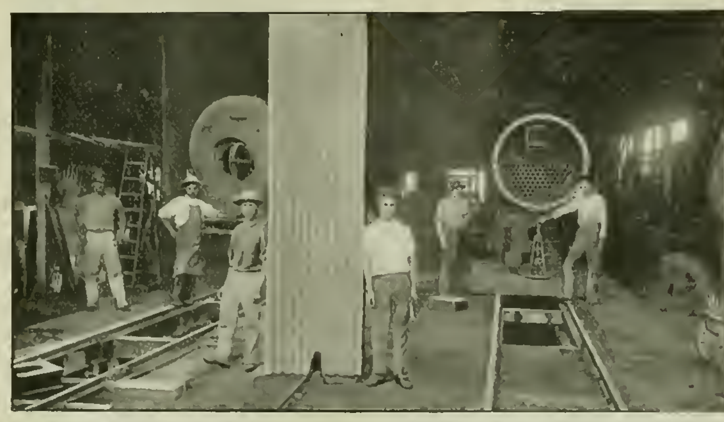
ENGINE HOUSE AND REPAIR SHOP, SANTA ANA RAILROAD.

There are 86 cars of English design, and 114 of the American build, with the standard M. C. B. truck, and equipped with the Westinghouse automatic brake. Thirty-one of the English cars are equipped with air-brakes. The trucks of the English cars are lower than the American; wheels are smaller in diameter, and have steel centers.

All freight cars have platforms. The box is built after the style of the old Union Line cars that were on the Panhandle Railway in the latter part of the seventies and early in the eighties. The roof is of galvanized iron, braced by angle irons. All draw heads are of wrought iron.

The low platforms of the cars compelled Mr. A. Hendee, the Westinghouse Air Brake Company's representative, who equipped the cars with air-brakes, to run the train pipe up through the platform. The angle cock stands about 8 inches above the beam, and when the hose is coupled to the American car it stands vertical.

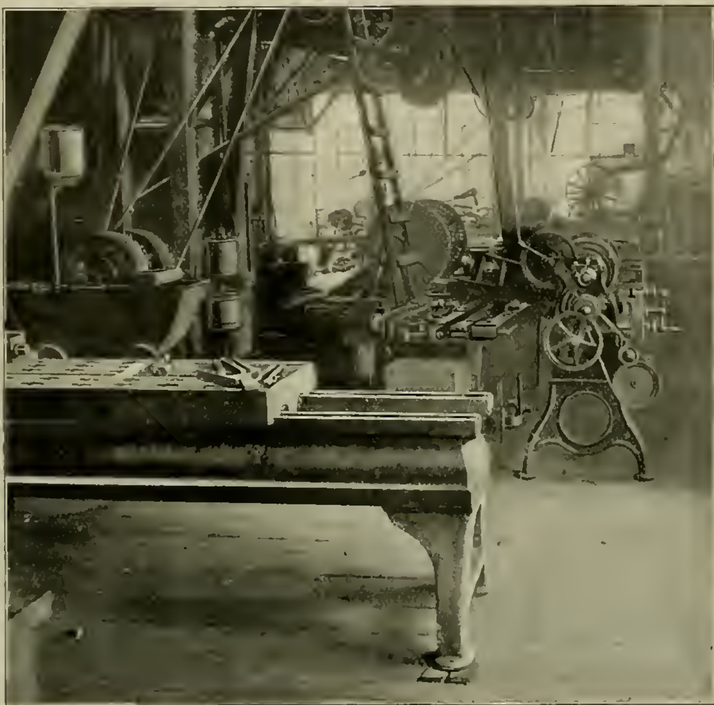
Mr. Hendee, who was, until recently, our master mechanic, designed a system of brakes to work without brake beams. It was an inside brake. As wood is very scarce with us, and iron for beams is expensive, it was a fine brake for this country. Mr. Hendee resigned as master mechanic, and therefore, never used his brake system on this road; but some of them are giving good service in Honduras.



ERECTING SHOP, SANTA ANA SHOPS.

The engines are all Baldwins except two. Engine No. 1 was built by the Union Iron Works, of San Francisco, in 1882. She is an eight-wheeler, and her spring rigging is under the fire-box. The man who designed her certainly had ideas of his own, for the engine is unlike any I ever saw, and I have been working on all breeds of engines for nearly twenty years. She is by far too long between centers for this road. Her wheel base is all out of proportion to her size. There is no door on the front end. The whole front must be taken down to see her steam pipes. She is entitled to a place among the freaks.

Engines from 6 to 11, inclusive, are first class 10-wheel Baldwins, outside crank, or paddle-wheel, as we call them, and all up to date with air-brakes, and Monitor injectors, sight feed lubricators, extension front, and 180 pounds boiler pressure.



AIR-BRAKE DEPARTMENT, SANTA ANA SHOPS.

WORK TRAIN, SANTA ANA RAILROAD.

Here in Salvadore a machinist's lot is not a happy one. Our pipe-dies and taps are all American make. Our pipe fittings and pipe are mostly all English, and it, therefore, requires considerable main strength and grief to bring good results. We manage to mix an American and English idea sometimes, and the service of the road for Central America is quite good.

All passenger trains carry a first-class horse car. A passenger can ride to the depot, buy tickets for himself and horse, and the horse is thereby made a first-class passenger. The scheme is a good one for these countries.

You can judge our shops and air-brake repair and instruction room from the photographs. The Acajutla and Santa Ana Railway can boast of having their shops nearer an active volcano than any railway in the world. We are about 12 miles from Izalco. It is always active.

The Ferrocarril de Santa Ana is not making any improvements in the mechanical department at present, as they are going to move from Sonsonate to Armania. Then I suppose we will have an air-brake room and more tools.

I am indebted to Conductor Cullen and Engineer Clisbie for the photographs which I send you.

FRED SELTZER.

Sonsonate, Salvadore,
Central America.

Automatic Lubricators and Relief Valves.

Editors:

Having read and noted the comments on things pro and con in your valuable journal, I wish to submit some of my views to your numerous readers who are interested in the present improvements in our present-day locomotives. The lubricator has had a good run on its merits, but will not feed oil to cylinders using full pressure from throttle. Its advantage over hand oiler is in having a deposit of oil in pipe ready to drop down as soon as throttle is shut off or pressure reduced in steam chest. If anyone considers the construction of lubricators—how the steam passes through condensing tubes, both on top of feed glasses, and the one to supply the necessary water to bottom of lubricator, to raise the oil—he will readily see that it has an impossibility to perform—to force oil against full steam-chest pressure with wide-open throttle. The most common complaint we hear from our men is, that the hand oiler will not take oil without throttle being shut off, but with lubricator throttle and lubricator open; or, in other words, they try to oil through the hand oiler rolling downhill, without disturbing the lubricator. Now, to do this, the suction of piston in cylinder must be strong enough to overcome the lubricator pressure or suck it down with the oil, or lubricator pressure will blow out of hand oiler valve when opened.

With the Nathan patent circulating valve attachment to lubricator, the same conditions exist; and if regulating screw of same is not screwed up tight enough to hold diaphragm valve seated against lubricator pressure, it is worse, for it gives a larger opening for pressure to hand-oiler valve. Now, this suction of piston on oil pipes with engine rolling is lost, or considerably reduced, by the use of the steam chest relief valve. This valve, in addition to this, has some other features. They are put on in connection with the pop valve to save chests, steam pipes, etc.; but do they do it? Let us see how they do. We have an engine working full capacity going up steep grade; our chests, cylinders and pipes are heated as hot as steam will make them. We turn over hill and shut off to roll, say, two or three miles. The relief valve opens, allowing, along with the dirt and grit flying loose, free admission for a large amount of cold air to rush into chest. The cylinders, being much heavier than the walls of chests, retain their heat and expansion longer than the chests, and if nuts on steam-chest studs are pulled up tight, the contraction of the chest creates a strain that the iron will not stand. This action being continuous when conditions favor it, I think they will burst more chests than they save. The chest pop is all right; but with our engines and trains equipped with power brakes, the necessity of reversing an engine in the present day is a rarity, and I think the relief valve should be given credit for having done its duty, and laid away. Those observations have come from eighteen years' experience in all branches pertaining to locomotive practice, in running and working as mechanic both in shop and roundhouse. I had intended to touch on other important points, but, fearing to take your space, I will close.

J. J. Flynn.

Louisville, Ky.

Babbitt and Journal-Wear.

Editors:

It is a pretty well known fact that no one likes to have his pet theories assailed. Certain persons get it into their heads that so-and-so is a good thing; they've never, perhaps, had any tangible intercourse with it, so to speak, but still they've got it rooted into their systems that it's so. They perhaps know or have heard that it answers all right in certain cases, and they straightway conceive an unbending and inconsiderate admiration for it.

I was talking with one of these gentlemen the other day, and the question of babbitt or white metal casually cropped up. His ultra-positive and unqualified assertions on its behalf were such that I could not resist remarking that, for all he said in its favor, the fact remained that it sometimes wore journals away much quicker than brass did. Of course, he proceeded to "give it me in the neck" for this; so much so that I left him pondering on the matter, trying to decide whether I was only mad or was trying to fool him.

I fancy, after all's said and done, that white metal is used more as a safety appliance than anything else. Take the case of a main crank pin or a journal brass, for instance; one naturally wants to give it all the chance he can, and sometimes workmen, with that idea, after having obtained a proper bedding, give a final scrape on the brass all round the edges of the pieces of babbitt, thus leaving the latter standing up above the brass, "the thickness of a piece of paper." This was the practice on the London & North Western engines when I was there. This humors the bearing for the first mile or two, till she's found herself. But as regards wear, it depends on other considerations; there are two sides to most questions. Babbitt in itself is all right if of a clean texture to start with; but there are contingencies; there generally are. I'll state one:

Some years ago, I was engaged on repair work in an English railroad shop, and had several old engines through my hands whose "big-end" brasses were (when new) as shown in Fig. 1, two gobs of metal being recessed in at *B*. I found, in every case, the crank pins worn as shown in Fig. 2. (All the engines were inside connected, as will be seen from the crank axle here shown.) I remember the case of these engines particularly, because it meant a lot of extra work for me, as the wheels used to stand in a yard with a lot of others, both new, stock and repairs; and often by the time I had in due course worked round to a particular pair of rods, their wheels had got into the middle of the wheel yard. Then, if new brasses were required, I had to go and true up the pins; this meant taking a chip (for I never file when I can chip, nor scrape where I can file) all round the pin, as shown dotted at *a*, afterwards filing and smoothing up with emery cloth and a coiled rope. Had to be on your back half the time, perhaps, if the cranks happened to be low down. Not much chance of getting twenty or more pairs pulled out so as to be able to roll the wheels round on a skid into a suitable position. I knew my foreman; he'd have said that any d——d fool could do a job when everything was just so. When you bear in mind that these pins were in between crank webs 12 inches wide, you'll perceive the beauty of the job, and understand how a frequent repetition of it would impress one's mind. Had often, it is true, to file up ordinary flat journals under same conditions, when I found them badly scored through heating; but that was a much easier job.

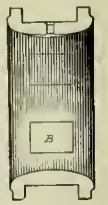


FIG 1

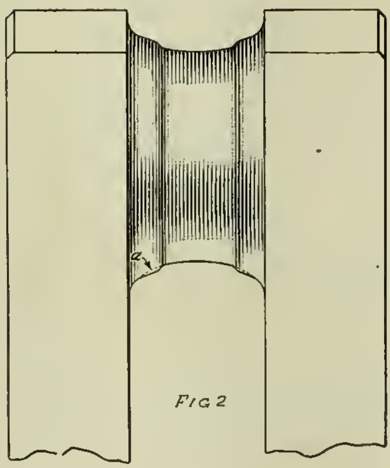


FIG 2

As regards the reason for this wear, it seems to me that the only explanation is, that the babbitt acts as a lap in conjunction with any grit that works its way in. The soft metal forms a matrix, holding the grit whilst the latter gets in its work. Or you can look at it another way: The wear will always come on the softest of two rubbing surfaces; hence the brass wears, and not the journal. This is also true of babbitt if it is clean to start with, in which case it will carry the wear instead of the journal. If, however, a lot of grit gets embedded in it, this will protect the babbitt, so to speak. It becomes a case of grit versus iron, and the latter wears the quicker. With hard bearings like brass or cast iron, the grit, I fancy, gets ground up, and, mixing intimately with the oil, is worked along out of the journal or other surface.

The engines in question were quite old. All the newer types had brasses as shown in Fig. 3, babbitted in the six holes *b*. Their pins seemed to wear all right though; the fact that they were steel as against iron in the other cases evidently does not affect the argument.

FIG 3

FIG 4

By the way, Webb, on the London & North Western, uses white metal bearings for his main crank pins, on some of his engines—as least he did when I was on that road, some years ago. The metal is run on to the "brasses" as shown in Fig. 4, which is a section through the crown of one of them. You have to make a good job of these "big-ends," too, or else the driver will soon find himself "up a tree." You must always keep them up to their work; on the one hand, you mustn't get them hot—on the other, you mustn't have too much slack. If they once get 1-16 inch, they'll soon have ¼ inch—"knock makes knock." As long as they kept all right they were a good job; wore like a bit of glass. But they had to be nursed. Sorry I can't say anything as to the rate at which these pins wore. Was younger then, and perhaps not so enquiring; added to which, it was a rushing shop, where one was paid to turn out work, not investigate. And besides, in dealing with repair jobs like this, you don't handle your scale at all. All you're concerned with is the size of the pin. You work to your calipers, and the turner to your pin wire gage, and you don't trouble yourself whether the journal is 8 inches or 7⅞ inches.

By the bye, this London & North Western metal was splendid stuff. You could conjure with it. It was like steel; you could stick a layer (and a thin one, too) on anywhere, from a slide block to the sides of a reverse lever, where the jaw of the catch works (you'll think this sounds "botchy"). I know of another English line that would save hundreds of dollars a year if they had Webb's white metal, if only for their main rods. I'll tell you about this some other time.

Now, I don't want you to think I am decrying babbitt; but some people have an exaggerated sense of its importance. It's all right where not exposed to sand or grit. Its adoption is, in fact, in keeping with the principle governing the use of all bearing alloys, namely, to transfer the wear from a surface you can't renew to one you can. We therefore deliberately make the latter the softer material, so as to throw the onus of the wear upon it. Thus, it is more easy to renew a valve than a valve seat; and if the former is made of bronze, it will wear in preference to the latter. This idea is carried still further on some English roads, by drilling the face of the valve full of ½-inch holes and filling up with babbitt. This was done in the case of both cast-iron and also bronze valves.

Talking of the uses of babbitt, it is of course needless to allude to the safety thereby gained. If a main crank pin runs hot, the driver's nose gives him timely warning, and he can always act in time to "avert a catastrophe," to use a newspaper expression. But with iron or steel bearings the case would be different. There's no give about them; no half-way measures, so to speak; directly they go wrong the damage begins. A certain superintendent of motive power in England once tried steel "little-end" bearings, and they made a grand job, until one day one of them got the chill off, and then—well, the whole side of the engine was torn down. It was all right whilst everything kept cool; there was no harbor of refuge, however, in the time of trouble, as with brasses; when the thing got hot, something had to happen. After this one breakdown, steel bearings were dropped like a hot potato.

I believe that, in a good many cases, it wouldn't be at all a bad thing if, when journals had once found their bearing, you could borrow a magician's wand and knock out the babbitt altogether.

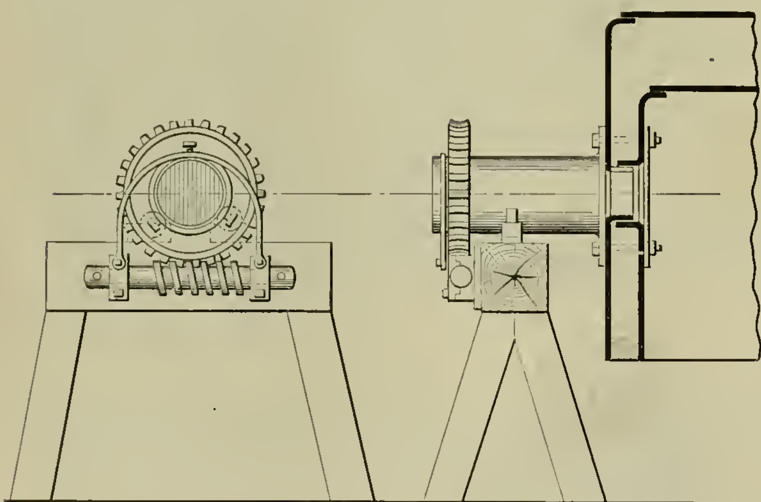
I knew a successful driver in England who preferred to run without babbitt in his "big-end" brasses—which, by the way, were same as shown in Fig. 3. If by chance he ran the metal out of a new pair, he'd always coax the fitter to put them up again with the holes empty. Being of a secretive nature, he'd never assign a reason for this, other than that it was a fancy of his.

A word, in conclusion, about the case in question. I fancy a lot of the trouble was due to bad babbitt. It was as soft as pap. Don't believe the wear would have been half as bad had Webb's metal been used. Also, the concave pins may have had something to do with it. It seems probable that the dirt would work down towards center of pin and stop there, whereas a flat journal would work it along and out sideways. I never had any use for these hollow journals, anyway. Nasty things to fit up, when the front end is not uncoupled. Of course, if you are sure you haven't taken too much off, and that the bearing is "brass and brass," you're all right. In the case of a flat journal with its ⅛-inch side play (that's what we generally give "over t'other side"), you can tell by the aid of your tommy bar how things are. You can't do that with the round journals, however.

I've used babbitt throughout in its popular sense, as synonymous with white metal. I don't suppose that 10 per cent. of the stuff now in use is made up according to Babbitt's original recipe. As a matter of fact, people can't agree as to what that was, at least as regards the proportions.

H. Rolfe.

Scranton, Pa.



Locomotive Engineering

WILEY'S BOILER-TURNING APPARATUS.

Apparatus for Turning Boilers.

Editors:

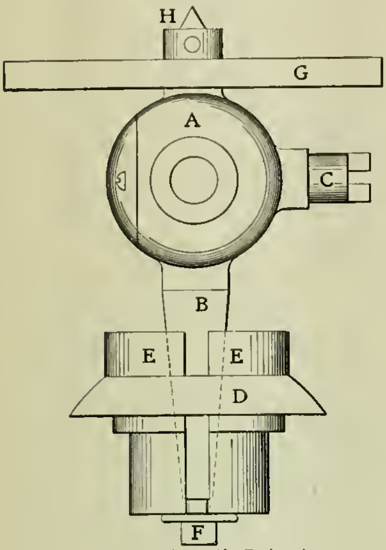
Herewith I inclose for your inspection a rough sketch (from which engravings were made) of a device for turning boilers undergoing repairs. The arrangement is now in use in these shops and is an entire success. It consists, as you will see by sketch, of two wooden trestles, one under cylinder of boiler and one under pipe attached to the fire door, two small rollers on each trestle, a worm wheel and a worm screw. The screw is attached to the trestle, and the wheel bolted to the pipe is flanged and riveted to a plate. Six bolts go through fire-door hole and through a plate washer inside of firebox and through the plate the pipe is riveted to, thus making secure without drilling out any staybolts. A 2½-inch angle iron inside of pipe at outer end is used to prevent collapse. The worm wheel is 24 inches in diameter, but should be 30 inches. One man with a bar 36 inches long turned a boiler weighing 9 tons in eight minutes, and the boiler having twenty-two crown bars and four braces to each crown bar, making it at least two tons top-heavy, taking the fire-door hole for a center. This device enables us to do all work on our boilers down handed, such as breaking staybolts, tapping staybolt holes, riveting and caulking, putting new sheets on cylinder, etc., enabling the men to do twice as much work, and better work than the original way, which has been overhead. This arrangement is very handy and quick, dispensing with blocking and all overhead tackle, therefore indispensable, in my opinion, in shops that have not got an overhead crane. The whole arrangement did not cost over thirty dollars, and was designed and made by me.

David L. Wiley,
Foreman Boiler Maker, C. R. of N. J.
Ashley, Pa.

Some Fall Brook Kinks.

Editors:

Grinding the joints of steam pipes is a slow and tiresome job when done by hand, contrary to the first impression of the visitor in a railroad shop. The application of power to this work through the medium of compressed air has been effectively solved by Assistant Superin-



Locomotive Engineering

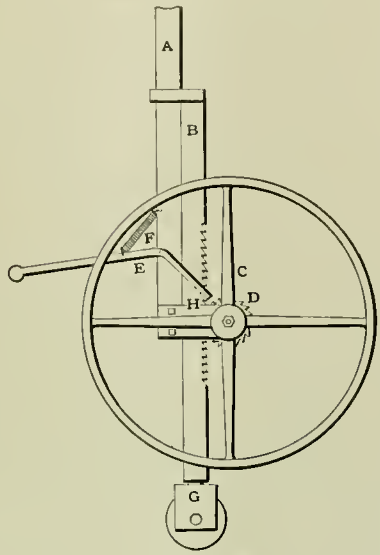
Fig. 1

tendent Williams. A compressed-air engine of the three-cylinder type is connected by a flexible shaft with the grinding rig shown in Fig. 1, which allows it to be used in any position desired.

The body *A* is a hollow brass shell carrying the spindle *C*, which is arranged for connection with the flexible shaft and which carries on its inner end a bevel gear driving the spindle *B*. The steam-pipe ring *D* is mounted, as shown, on the four wooden segments *E E*, which are fitted on their inner surfaces to the tapered shaft *B*, and are held in place by the screw *F*, forming a sort of expanding mandrel arrangement. For convenience in use, a wooden handle *G* is provided. Where considerable pressure is required the feed screw *H* is used. However, this feature is seldom needed, as the surfaces are always reduced to the best possible condition by the file and scraper before grinding. Altogether, it forms a neat arrangement and insures good work of a class which is often neglected.

Another effective tool is the bolt-starter, Fig. 2. It is, in fact, a hydraulic press in miniature, but of extraordinary power, as a pressure exceeding 60 tons has been exerted through it, and that with the piston *A* of only 2¼ inches in diameter, or a trifle less than 4 square inches, equaling 15 tons per square inch. The material for filling is tallow, which has the advantage that it does not ooze or evaporate while not in use. The piston *A* is provided with cup leather packing, as is the screw *D*; but in the latter case it is not forced to turn by the rotation of the screw, but is loosely attached to it by the through bolt *E*.

The bolt, which receives the full force capable of being exerted by this press with a 30-inch wrench on screw and a



Locomotive Engineering

Fig. 3

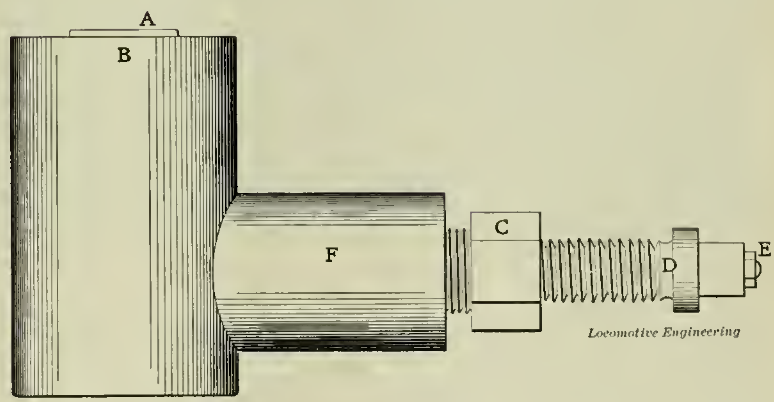


Fig. 2

lusty arm pulling the wrench, is a hopeless case for anything less than a drill. Loose drivers have been forced back on their axles by it, when not expedient to remove them from the engine and use the regular wheel press.

A rail-bender built on the same lines is a very effective tool for making guard rails, curves for turn-table, etc.; two men doing with ease the work of four or more with the ordinary screw rig.

A piston-rod starter is also in use on the same principle, being made for Laird cross-heads; the body of the tool taking the place of the cross-head pin, with a small piston fitted in it at right angles, so as to come in line with the end of the piston rod. A piston-rod fit which baffles the wedge and heavy hammer yields to the persuasive power of this tool in a way quite astonishing.

Atmospheric pressure is sufficient in all these tools to force the piston back to its normal position, when in proper condition, by merely backing out the screw.

A convenient hoist for steam-hammer work is to be seen in the blacksmith shop, and is the design and work of one of the men employed there. As seen in Fig. 3, it consists principally of the wheel *C* and rack *B* with the pinion *D*. A catch *E* is provided, held in position by the coil spring *F*. The whole rig is suspended on springs, not shown, to reduce the shock.

Fred E. Rogers.

Corning, N. Y.

What Is Proper Drafting?

Editors:

The application of the answer to this question to the motive power of a railroad is what reduces the cost of handling trains to a minimum, makes the officials congenial and proud of the coal mileage as reported by their performance sheets, makes the lives of those who trail the rail pleasant ones, and is a perfect remedy for that tired feeling experienced by enginemen upon their arrival at a terminal after scheming day and night to keep the crown sheet damp and hold enough steam to call for the semaphores.

When you see the left side of a fireman's overalls scorched and brown; when the engine is continually burning liners off the fire-door; when it becomes necessary to load either end of the firebox with coal to avoid turning the fire when the engine is notched on a hill; when it is necessary to fire with double the amount of coal in either end of the firebox to maintain a level fire; when holes are torn in the fire over sections of the grates; when on inspecting the fire after it has been allowed to burn down, the coal has been entirely consumed, leaving nothing but the dead ash in one end of the firebox, while in the other end there is a bright fire, you can make up your mind something is radically wrong with the drafting of the engine.

How, then, should they be drafted? Some will say that the draft should equalize; that is, distribute the draft equally throughout the entire grate area, causing each square foot of grate to consume an equal amount of coal; and might say the minimum amount for the maintenance of any required pressure on the boiler. Some will say, let the draft be slightly stronger through the rear grates, because with the draft strongest there the most coal will be consumed there, giving an opportunity for the gases and smoke to be better consumed in passing over the remainder of the grates to the flues. Others will say, draft slightly stronger through the front grates, for in so doing the lower flues that have a tendency to choke and fill up will be kept open there by utilizing the entire heating surface.

If any variation of draft is made at either end of the firebox, it should be very slight; for if it becomes excessive, it detracts from the remaining portion of the grates. The part of the grates through which the volume of the draft is passing may be entirely too small in area to maintain the temperature of the heating surface for any required pressure, causing the engine to be an excessive coal burner, and will make steam with difficulty. Should this draft be not quite so condensed, but diffused over a little more of the area by using a good quality of coal, the engine may be made to steam, but will make a very poor coal mileage.

With this varying of the draft through the grates comes unequal temperature against the flue sheet and through the flues, the heat passing through some of the flues faster than it can be absorbed; while through others carbon monoxides, caused by an insufficient amount of draft or air through part of the grates, are passing. As monoxides contain about 30 per cent. less heat than the dioxides, it will readily be seen that the calorific properties of the coal are not being properly utilized.

W. J. Torrance.

Evansville, Ind.

Grate Bars Did Not Drop.

Editors:

Would you please allow me to correct a statement made in your last issue, saying that the grate bars dropped from a locomotive on the Morris & Essex division, Delaware, Lackawanna & Western. The real cause of all the delay was that the boiler check on the right side of Engine 116 stuck up, and the engineer could not get the left-hand injector to go to work; so he took the safe side, and pulled his fire. This information I got from an engineer on the above road.

W. A. Eagles.

[On most roads the engineer would have been "disciplined" for that job, as it meant habitual neglect of left-hand injector.—Ed.]

Small Expenditure of Valve Oil.

Editors:

Knowing you to be interested in the economical handling of locomotives, I wish to call your attention to a run made by Engine 135, for valve oil, as shown by performance sheet for December, 1897. This engine is credited with making 4,600 miles on seven pints of valve oil. Engine 135 is a Schenectady engine, 19 x 24; 5 feet 10 inches wheel. She runs from Ennis to Denison, a distance of 107 miles; is in passenger service, and train is from five to six, and sometimes seven, cars. Engineer, H. Gentry. What do you think of it?

C. A. Beckwith,
Houston & Texas Central R. R.

Ennis, Tex.

[That is a good record, but we have done better. The writer fired and ran locomotives for seven years without using any valve oil. All the locomotives on the road—and there were about 100 of them—made similar records. When the engines went in for repairs the valves looked like a bird's-eye map of the Rocky Mountains, and the cylinders looked like a well-plowed field. We reckon that saving valve oil increased the coal consumption 25 per cent. We suspect that the same money saving has resulted from the small quantity of valve oil used on the engine our correspondent refers to.—Ed.]

Apathy in Putting On Automatic Couplers.

Editors:

I notice that the railroads have been granted an extension of time to put on automatic couplers and power brakes on cars and engines used in interstate traffic.

The plea of some roads has been—they have not been able, on account of the light business they have been doing during the past three or four years, to take out the old couplers, which apparently were as good as ever, and consign them to the scrap pile and put automatic couplers in their places. As far as old cars which have not had any repairs made on their draft rigging since this law was first framed, this argument seems reasonable; but I would like to ask why we see so many cars and engines, either new or entirely overhauled during the past year or so, come out of the shops with the old style of couplers—in some cases brand new couplers of the old style being used. I have noticed several engines shown in the engravings of your paper, showing the old couplers on new engines, and I see cars every day that have either been built or repaired within a year or so with the old style still in use. Why should not all new engines and cars have automatic couplers provided when built; or whenever an old draw-bar has to be taken out of a car, why not replace it with an automatic coupler? It seems to me a great many would be changed in this way in making repairs. The only saving in putting in old draw-bars is the difference in first cost, and won't this be more than balanced when that draw-bar has to be removed and a new one put in its place after all? The only gain I can see is the use of the old, cheap draw-bar for a while longer, and when the new one is put in it is not a year or so old. This gain is lost several times over at the scrap pile, as a great many of the draw-bars which will some day find themselves there will mean to their owners a loss of almost their original cost.

Geo. W. Titcomb.

Saco, Me.

[The practice which our correspondent refers to is unfortunately very common all over the country, and it is a conspicuous sign of bad management. The practice reflects the policy, "Let us do everything as cheaply as possible to-day, for to-morrow we may be fired out."—Ed.]

Moving an Engine with Wheels Misplaced.

Editors:

In looking over the February number, I find, on page 83, the question and answer, "Effect of Changing Main Driver End for End." Experience comes ahead of theory. Some two years ago I took the wheels out from under an engine to have her tires turned; took them to Brooks shop. When they came back, everybody was in a hurry, and wheels were put into her just as they stood. Engine was closed up, fired up, and ready to go. In forward motion she started back. They called me. I found wheels end for end. Disconnected tank from engine, run engine on table head first, and back into shop head first, reversing lever in back motion, reversing main wheels reverse motion of engine. I do not intend this to criticize anyone; merely my own experience. Yours truly,

C. A. Sherman,
Foreman Shops.

Dunkirk, N. Y.

[We have no doubt that the experience of our correspondent is exactly as detailed, and the fact that the engine moved back does not disprove our proposition, for the reason that we attempted to demonstrate by lines what would occur under certain conditions. This reasoning looks right on paper. Is it not possible that the coupling up of the eccentric rods had something to do with behavior of the engine referred to above? We have known engines to have the go-ahead rod coupled to the back-up eccentric, and move in the opposite direction to that intended.—Ed.]

Ogdensburg & Lake Champlain Compound.

The annexed engraving shows one of a group of compound consolidation engines lately built by the Schenectady Locomotive Works for the Ogdensburg & Lake Champlain Railroad. The following are the leading dimensions of the engines:

Fuel—Bituminous coal.

Weight in working order—153,000 pounds.

Weight on drivers—135,500 pounds.

Wheel base, driving—15 feet.

Wheel base, rigid—15 feet.

Wheel base, total—22 feet 10 inches.

Diameter of cylinders—H. P., 22 inches; L. P., 34 inches.

Stroke of piston—28 inches.

Horizontal thickness of piston—5¾ and 4¾ inches.

Diameter of piston rod—3¾ inches.

Size of steam ports—H. P., 20 x 2⅛ inches; L. P., 23 x 2⅛ inches.

Size of exhaust ports—H. P., 20 x 3 inches; L. P., 23 x 3 inches.

Size of bridge ports—1⅜ inches.

Kind of slide valves—Allen-American balanced.

Greatest travel of slide valves—6½ inches.

Outside lap of slide valves—H. P., 1¼ inches; L. P., 1⅛ inches.

Inside lap of slide valves—⅛ inch.

Diameter of driving wheels outside of tire—54 inches.

Material of driving wheel centers—Cast steel.

Driving-box material—Main, cast steel; balance, steeled cast iron.

Diameter and length of driving journals—Main, 8½ inches diameter by 11 inches; balance, 8 inches diameter by 11 inches.

Diameter and length of main crank pin journals—6½ x 6 inches, and 7 inches diameter by 5¼ inches.

Outside diameter of first ring of boiler—62 inches.

Working pressure—200 pounds.

Material of barrel and outside of firebox—Carbon steel.

Thickness of plates in barrel and outside of firebox—⅝, 11-16, ½ and 7-16 inch.

Firebox, length—108 3-16 inches.

Firebox, width—41 inches.

Firebox, depth—Front, 67⅞ inches; back, 64⅞ inches.

Firebox plates, thickness—Sides, 5-16 inch; back, 5-16 inch; crown, ⅜ inch; tube sheet, ½ inch.

Firebox water space—Front, 4 inches; sides, 3½ to 4 inches; back, 3½ to 4½ inches.

Firebox crown staying—Radial stays, 1⅛ inch diameter.

Tubes—Charcoal iron.

Tubes, number of—306.

Tubes, diameter—2 inches.

Tubes, length over tube sheets—13 feet.

Fire brick, supported on—Water tubes.

Heating surface, tubes—2,069.5 square feet.

Heating surface, water tubes—11.5 square feet.

Heating surface, firebox—162.1 square feet.

Heating surface, total—2,243.1 square feet.

Grate surface—30.8 square feet.

Smokestack, inside diameter—18 inches top, 16 inches near bottom.

Smokestack top above rail—14 feet 1¼ inches.

Boiler supplied by—Two injectors, Monitor No. 10, R. and L.

Weight of tender, empty—36,300 pounds.

Journals, diameter and length—4½ inches diameter by 8 inches.

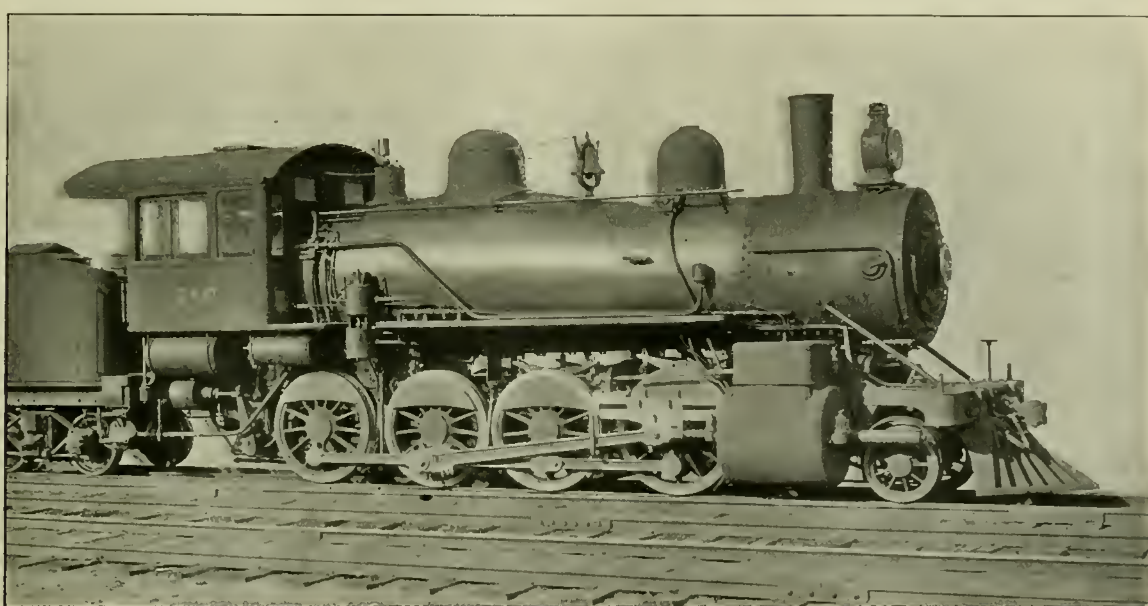
Wheel base—15 feet 3 inches.

Tender frame—10-inch steel channels.

Total wheel base of engine and tender—49 feet 11 inches.

Total length of engine and tender—59 feet 5 inches.

Engine provided with: Two 3-inch Crosby safety valves; McIntosh blow-off cock; Westinghouse-American brake on all drivers, tender and for train, 9½-inch air pump; magnesia sectional lagging on boiler, dome and cylinders; Leach sand-feeding apparatus; Trojan coupler at front of engine and rear of tender; Kewanee tender brake beams; one 18-inch headlight (maker, "Star"); Ashcroft steam gage.



OGDENSBURG & LAKE CHAMPLAIN COMPOUND.

The Pennsylvania Railroad Company are reported to have ordered a hydraulic riveter of 100 tons capacity for their shops at Altoona.

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The Value of the Ultra Practical Engineer.

The ultra-practical man who declares that he has no use for the scientific principles of engineering, is not so common as he was, but his voice is still heard in workshops, engine houses, and even in more imposing places. The men who talk in that way send forth the brayings of ignorance; but, unfortunately, the sounds are sweet to certain mentally lazy persons who would like to learn all that is necessary about engineering matters, without the exercise of any mental effort.

It is wonderful the amount of mental laziness there is among people who have not received good rational discipline in their youth. Men who will labor with their hands early and late, and who are industrious and energetic physically, are frequently infected with intellectual paralysis when they find it necessary to study something by aid of books. They do not realize that books contain the work done and discoveries made by previous generations of investigators. The expression Science is to these men abhorrent. Yet the science of anything is a very mild and harmless thing when it is examined without fear or guile. The science of a subject is nothing more or less than the statistics of collected and digested facts that have been gathered from various sources. Every science is founded on what people have found out about the subject. The growth of the science of steam engineering is a good illustration.

Thousands of years ago certain wise men of the East knew that when water was heated that it turned into vapor which could be made to do work. They also knew that air and water expanded when heated, and they made toy fountains that were operated by that motive power. The patient labors of investigators may have been expended for centuries in finding out these meagre facts. Yet they were the foundation of what is now known as the science of thermo-dynamics, a rather high-sounding name for the philosophy of facts relating to the mechanical action of heat.

There was from about the beginning of our era a long season of darkness when no new facts were learned about steam, and perhaps important discoveries were lost. It was well into the sixteenth century before anything new was added to men's knowledge of steam. This was the discovery, by Dr. Cardan, an Italian, that a vacuum could readily be created in a closed vessel by the condensation of steam. The value that his contemporaries put upon Dr. Cardan and his discovery may be inferred from the fact that writers of the day called him "a philosopher, a juggler and a madman."

That madman's discovery, nevertheless, formed the basis of nearly all experiments to make steam do useful work for nearly two hundred years, until about 1705 Newcomen, an Englishman, applied steam beneath a piston, then condensing it and creating a vacuum that utilized the pressure of the atmosphere to push the piston down.

During the two hundred years of waiting to do something of practical value with heat through the medium of steam, philosophers in nearly all countries in Europe were experimenting. Each investigator learned a little, and succeeding investigators used the facts obtained to guide their own researches. Methods of expelling air from vessels where a vacuum was to be created by the condensation of steam were improved; vessels to endure pressure were strengthened; the safety valve, the plug cock and a great many other appliances necessary for controlling and regulating the flow of steam were brought into use. By small driblets the stream of steam engineering knowledge was increasing in volume, and every succeeding engineer was utilizing the discoveries of his predecessors to greater advantage. Among the most useful of the lessons of experiment and experience were those which taught investigators practices that ought to be avoided. It has ever been thus in the discovery of facts relating to steam.

In the construction of his atmospheric engine, Newcomen combined a variety of apparatus previously tried by others, and produced a train of mechanism that harnessed steam, so to speak. His engine was exceedingly crude, cumbersome and slow-acting, but it was the direct progenitor of the modern steam engine. Steam was admitted by hand-operated valves to the lower end of the cylinder; then it was condensed by flooding the outside of the cylinder and the piston with cold water. When the vacuum was formed by this means down came the piston with a crash and it was ready for a new stroke. The speed of the original engine was six or eight strokes a minute. When this engine had been at work for a year or two pumping water to the entire satisfaction of the owners, it, one day, started off at about double speed, to the amazement of those in charge. An inspection showed a hole in the packing of the piston, which had permitted the water for condensing to pass inside the cylinder, where it did its work much more expeditiously than when it was kept on the outside. The man in charge profited by the accident and the jet condenser had invented itself.

It would be tedious to follow, step by step, the improvements effected on the engine for the next fifty years, till James Watt made a radical change on the Newcomen engine by employing a separate vessel for the condensation of the steam. By this time the latent heat of steam had been discovered and also a great many other facts which indicated the wonderful future for this means of using heat as a mode of motion. But the engineers who took the lead in giving to the world the wonderful blessings imparted by the use of steam were men who had studied what others had done before them. They added the discoveries of the past to their own labors and became leaders. There were no doubt ultra practical engineers in those days, who considered themselves wonderful fellows because they could start and stop the engines and keep the steam up. They, no doubt, imagined that they knew all about steam engines that was worth knowing, and despised the savants who were scheming to produce improved condensers that would convert all the used steam into water; valve gear that would utilize the expansive force of steam, and all the other changes that converted an apparatus of shocks, bumps and screeches into a smooth-running steam engine. The savants were often mere mechanics, blacksmiths, millwrights, mining foremen and copper workers who were of inquiring minds and learned all they could find out about steam and the machine to which it imparted motion. The ultra practical men passed away like other nonentities and other animated machines, leaving no mark behind them. The savants reached glory in their own time, and their names will be celebrated as long as industrial triumphs move men to admiration.

What was true of the passive man and the man of endeavor in the past is true to-day. The man who is willing and ready to learn what former generations have found out about his business is the man whose future, worked out by his own hands, will have something for succeeding generations to imitate.

Diameters and Areas.

Nearly all mechanics are becoming so familiar nowadays with figuring up areas of circles, that they are not likely to make the mistake of supposing that a 4-inch flue is only double the cross-section area of a 2-inch flue. Yet mistakes of that kind were very common a few years ago.

A very serious blunder that resulted from this ignorance happened some years ago, and a highly successful master mechanic failed to detect the mistake. He sent word to a division foreman to double the capacity of a pipe that supplied water to a certain water tank. The foreman examined the pipe and found it 2 inches diameter, so he ordered several hundred feet of 4-inch pipe, thinking that that was the way to double the size of a 2-inch pipe. The requisition passed the master mechanic's office without detection, and the pipes would have been laid down had a draftsman not happened to see some correspondence about where they were to be sent. He detected the mistake and made the others understand that measuring the diameter and doubling it increases the cross-section area four times instead of two times. The problem when figured out is, of course, 2 inches diameter equals 3.1416 square inches area. That multiplied by 2 gives 6.2832 square inches, the cross section wanted. The diameter of a pipe that will produce that opening is found by dividing the quotient 6.2832 by .7854, then taking the square root of the quotient, which gives the diameter of the pipe equal to twice that of the 2-inch pipe. In other words, the diameter required is 2.83, which is about equal to 2 13-16 inches.

Young mechanics who are ambitious to understand the mechanical calculations of their business will find this a good problem to practice on. They can take all sizes of pipes and figure their capacity out in relation to other sizes.

How Large Can Grate Area Be Made Advantageously?

In the February number of Locomotive Engineering there is an engraving showing one of a large number of Erie locomotives that have been changed from simple engines with ordinary fireboxes to Vauclain compounds with Wootten fireboxes. The change has excited surprisingly little comment considering its importance, for it involves a most enterprising experiment, or else displays a knowledge of facts respecting the use of fireboxes with huge grate surfaces that are not in possession of railroad men generally.

These engines with the Wootten fireboxes are to be employed all over the main line of the Erie system, which extends from New York to Chicago, and therefore entails the use of bituminous coal for fuel on a considerable part of the railroad's mileage. The experience of other railroads with Wootten fireboxes seems to have indicated that they were not successful as good steam-makers, except when burning very fine coal. Some engineers appear to think that the greater the grate area of a boiler the more water will be evaporated per pound of coal burned; but others hold that a point may soon be reached in a locomotive where the grate area is too large for the economical consumption of fuel. Both sides appear able to cite facts in support of their opposing contentions, and it may be that the introduction of so many locomotives upon the Erie system with Wootten fireboxes may settle an important question that has long been in doubt.

The Erie people have had a good many locomotives in use for several years with Wootten fireboxes, and it is to be presumed that they knew what they were about when they determined to make the wholesale change referred to; but the experience of others who used bituminous coal in Wootten fireboxes does not seem encouraging to the success of the new venture. Until the Erie people began using Wootten fireboxes for the burning of bituminous coal, no railroad made a success of engines of the same kind burning that fuel. This does not, however, imply that success is impossible, for many things that have been failures have ultimately been made to work satisfactorily.

During the earlier life of the Wootten patents vigorous efforts were made by those interested in the invention to induce railroad companies to patronize that style of firebox; and not a few railroad managers were persuaded that the large grate area would lead to material saving of coal, or that it would make practicable the use of inferior coal. This led to engines of that type being tried on the Wabash, the Chicago, Burlington & Quincy, the Union Pacific and other Western roads, but they proved expensive experiments, although the engines were able to burn inferior coal that would not make steam in smaller fireboxes. The action of bad feed water seems to be peculiarly destructive to Wootten fireboxes, and probably did more than anything else to make locomotives with Wootten fireboxes unpopular on Western railroads. Another thing that militates against them is that Western locomotive engineers do not take kindly to being located on the top of a boiler, and that man's influence is very strong in turning the public opinion of a railroad against any particular class of engine.

The overwhelming testimony of the men at the heads of the mechanical department of Western railways, where Wootten locomotives were introduced, was, that the fireboxes were excessively expensive to maintain, and that repairs had to be made so often that the engines lost mileage through that cause of delay. If an engine for any cause fails to take its turn with the others, it soon becomes an expensive luxury, for a few pounds of coal saved per mile is of small consequence in comparison with having the engine constantly at work, especially in busy times when locomotives are scarce. There were constant complaints that the Wootten locomotives were notorious for leaky tubes. This is not the case on Eastern roads, where these engines burn anthracite slack; but there were, no doubt, peculiar causes in the West which brought about this undesirable condition of things. A firebox that has flues leaking a great part of the time is certain to waste coal, lead to annoying delays, and to cause irritation to everyone interested in having the engine do its work satisfactorily.

It is likely that the Erie engines burning bituminous coal will throw light upon the question of what size of grate can be used to the best advantage in burning the ordinary run of coal. Experiments made on the Purdue University locomotive testing plant seemed to indicate that a decrease of water evaporation per pound of coal went steadily on as the fuel burned was increased beyond 30 pounds per square foot of grate area per hour. An engine with a Wootten firebox on the undulating roads of the West will frequently be required to burn less than ten pounds of coal per foot of grate area per hour. Steam engineers designing a stationary engine plant will not, if practicable, provide less grate area than what is necessary to keep the coal consumption about twenty pounds per square foot of grate area per hour, but practices which are unquestionably sound in stationary boiler practice with natural draft are altogether wrong with the forced draft and varying conditions of steam generation that prevail with locomotives.

No matter what the grate surface of a locomotive may be it must be covered over all the time the engine is working steam to a depth sufficient to prevent the admission of air so freely as to lower the gases of combustion below the temperature of ignition, or the point where combination of oxygen with the carbon and hydrocarbons of the fuel takes place. If the air comes in to depress the temperature below that point, a refrigerating effect follows, and the air is wasted cooling the fire and heating surface.

A somewhat edifying experience of this was gone through by the Chicago, Burlington & Quincy in the early eighties, with two Wootten locomotives which they purchased. It was found in the ordinary run of work, while burning screened coal, that these engines did not work so satisfactorily, while burning more fuel than common eight-wheel engines that were doing the same work. Mr. Wootten happened to be in Chicago, and wanted to try one of these engines in hauling twice the weight of train it had been accustomed to handle indifferently. When he examined the coal, however, he refused to use the lump quality and insisted on obtaining slack. That was procured, and the performance of the engine was away beyond anything ever seen before. The engine steamed freely, a thing she had never done before. The reason of this is easily enough identified. The slack coal made such a compact bed on the grates that there was no air passing up through holes to perform the refrigerating process. A fatal objection to the utility of the engines was that there was not a steady supply of slack coal procurable, and they kept up their bad reputation until changed.

The grate area of these engines was certainly away beyond the size practicable with ordinary bituminous coal as fuel. Covering up two feet in front of the grates might have helped matters and led to a fair average.

The Erie people have now so many of these engines in their service that they must be made to work successfully. It may be that the company have arranged to have a bountiful supply of slack coal, but if that cannot be done the engines must be made to burn run of mine coal. The changes necessary to do that properly will be interesting to every one who is concerned in finding out how large the grate area of a locomotive can be made to advantage.

Hot Hand Rails.

Simplicity is a very desirable thing in locomotive designing, and it is a good plan to reduce the number of parts as much as possible; but this sound tendency may be carried too far. It is quite a number of years ago now since a master mechanic, with a genius for reducing parts, used one of the hand rails of the locomotive as a steam pipe for the blower. The plan was not new, for the writer fell off an engine in Scotland thirty years ago, because his hand failed to keep hold of a blower-pipe that was used as a hand rail. The man in charge of the principal machine shop was responsible for the hot hand rail, and he refused to change it, saying that a man could easily take a piece of waste in his hand to prevent the skin from getting roasted. It was only after another man fell off an engine from the same cause, and got nearly killed, that the danger was admitted and a change made. Part of the convincing argument against steam pipes as hand rails was the arresting of the locomotive superintendent by direction of the sheriff substitute of the county where the accident happened.

There are no sheriff substitutes in America with power to order the summary arrest of men who seem responsible for loss or jeopardy of human life, and that is perhaps the reason that locomotives are to be found in different parts of the country with steam-heated hand rails. There is no excuse for the practice, and it ought not to be tolerated. Within the week one of our correspondents sent word that he could not write, because he was suffering from a badly burned hand. He had the option of falling off the engine of an express train or of roasting his hand. It is simply brutal to make an alternative of that kind.

Preventing Radiation of Heat.

An important contribution to the subject of boiler and steam-chest covering was made in a paper contributed to the New York Railroad Club by Mr. Wallace W. Johnson. The author of the paper seemed to be thoroughly conversant with the advantages of having hot surfaces protected from radiation of the heat generated, although some of the engineering authorities cited, such as Stephen Roper, were simply ridiculous.

If there is any one important means of heat-saving habitually neglected more than another by many railroad men, it is the conserving of heat after it is generated. They will spare no labor and ingenuity to make a boiler generate as much steam as possible per pound of fuel; but after that is attended to, they seem to think that their full duty in the interests of economy is entirely performed. This is a subject to which we have devoted a great deal of careful attention, and we firmly believe that the losses that result, in locomotive practice, from leaving the hot surfaces exposed to refrigerating influences wastes more heat than even the work of the poor fireman. The losses from the hot surfaces being improperly protected is something of an unknown quantity, and therefore do not appeal strongly to the man who really desires to have the locomotives under his charge operated as economically as possible.

When an engineer uses 30 cents' more oil than another one in going over a division, there is explicit basis for discipline, even though he may do the work with a saving of two dollars' worth of coal; but when a locomotive with sieve-like lagging loses one-tenth of the heat utilized by one which has the boiler, cylinders and steam chests properly protected, the measure of the saving is absent, and the wasteful boiler and other parts are reputed to be just as good as those that hold the heat generated.

We know of no important department of locomotive engineering which has received so little intelligent attention as the advantage of having the radiating surfaces properly protected. Experiments made on testing plants, and by no end of engineers using the steam-engine indicator, show that the condensation of steam in locomotive cylinders varies from 20 to 45 per cent. There are few engines that do not lose the use of 25 per cent., or a quarter of the steam generated, before it begins to push the piston. A considerable part of this loss is beyond prevention, but there is a large part of it which results from the cylinders being poorly protected. That part can be saved by the use of good non-conducting lagging.

For the reason that the losses from radiation are not readily apparent, wood boards have been the material principally used for locomotive lagging, and we know of nothing less efficient for the purpose. The only argument in favor of wood as lagging is that it is cheap in the first instance, and the shop carpenter knows how to put it on. It is no sooner on than it becomes a sponge of holes, through which the air of heaven passes freely and carries away the fuel products to raise the temperature of the surrounding atmosphere.

A good object-lesson of what this useless diffusion of heat means may be learned by standing on a station platform when a locomotive passes. It sends forth a warning for yards in every direction, and everyone within its influence feels that the passing heat is a source of comfort to the whole country. All that heat which gives transitory comfort ought to be held in the boiler and steam chest to do its best in hauling and heating the train.

It would not be difficult to make a fairly useful test of the difference in heat-loss between a well-lagged boiler and one that had the radiating surfaces poorly protected. When the Purdue University had their first locomotive in the test department, it was found that when the fire was drawn at 5 in the afternoon, steam went entirely down about midnight. The boiler was lagged with wood. The new engine, whose boiler is lagged with magnesia covering, has steam in the morning, after the fire has been drawn at 5 o'clock. It would be interesting to take two locomotives, one lagged with wood, the other with recognized good non-conducting material; draw the fires at the same time; see when the steam on one went down; start a fire and ascertain how much coal it would take to keep the steam up till the other became cold. That would not be a conclusive test, as much of the loss is in the cylinders, but it would provide facts worthy of consideration, especially if the engines were kept outside on a cold night, exposed to a strong wind.

A rather edifying part of Mr. Johnson's paper is the statement that all the high-claim insulating laggings are not what they seem, or what is claimed for them. He intimates that the heathen Chinee was nothing for "ways that are dark and for tricks that are vain," compared with the man who offers composite boiler covering to railroad men. We are inclined to believe that the gentle imputation does not much miss the mark. We believe that a great many foul mixtures of plaster of Paris, which are really lime sulphate and other abominations, have been offered and sold to railroad men as asbestos and magnesia. Our advice is—insist on the material being up to a certain specification, and if it comes short of that when careful tests are made, reject it. The reason why so much inferior stuff is imposed upon railroad companies is because many of the latter are miserly about spending a dollar on having tests made. The expense of test departments was the first to be cut off when hard times came on, and railroad companies have been the principal sufferers, while knaves have reaped a rich harvest.

Canal Extension Frauds.

One of the worst frauds imposed upon a long-suffering public has been the huge sums of money expended upon the Erie canal. In spite of all that politicians could do to keep up that grand object of an appropriation, the canal steadily decreased in popularity till there was danger of its falling into utter desuetude, when the public robbers induced the people of the State of New York to spend nine millions more money upon the canal on the pretense that the streak of water between New York and Lake Erie was necessary to keep down railroad rates. Now that the nine millions of dollars are nearly spent, the politicians have the audacity to ask the people for seven millions more to throw into that ditch.

There is nothing so effectual in catching rustic votes as the pretense that an act is against the interests of railroads, but it is passing strange that people living in the country help so readily to waste money on canals when so little is done to make and maintain decent roads. For a State having plenty of road-making material nearly everywhere, New York is disgracefully behind other States with its public highways. Farmers lose more in one winter through the obstacles to transportation due to bad roads than they would gain in a lifetime from reduced rates due to water competition. An Indiana engineer who has devoted great attention to the subject of haulage on different kinds of roads, reported the other day that the cost to move one ton one mile by horse-power over a dry, sandy road was 64 cents; over wet sand, 32 cents; over ruts and mud, 39 cents; over broken stone and ruts, 26 cents; over an earth road that is dry and hard, 18 cents; over a broken-stone road in good condition, 8 cents; over a compact gravel road, 8.8 cents; over stone pavement, 5.33 cents; over asphalt, 2.7 cents. If wagon transportation could be carried on at a cost of 5 cents per mile per ton, the result would be a saving of many millions of dollars, and would put in motion many millions of tons of merchandise that cannot now be handled with profit.

Public money spent to bring forth results of this kind benefits the whole State, while canal appropriations benefit few except those spending it.

What Is a Locomotive?

One of our correspondents takes exception to calling the electric motor which we illustrated in the February number, a locomotive. He claims that a locomotive is something that motes on its own hook, without any clothes-pole attachment to the source of power. He doesn't object to the electric motor as long as it is called a motor, but it seems to grate on his nervous system to call anything a locomotive that isn't capable of going it alone as long as fuel or power holds out.

It may be a fine line to draw, and we don't know what the exact technical definition would be; but we are inclined to think his point is well taken, although it matters little what we call a thing, as long as it does the work. According to his line of argument, a storage battery car or a compressed air car would be a locomotive, but a trolley or cable car would be barred on account of being always dependent on an outside power.

He also takes the position we mentioned in a previous article, that as long as current must be furnished by a steam-driven dynamo, the wasteful (?) steam locomotive will continue to mote, except in special instances where conditions warrant the other system.

There is one particular feature of operative railroading that appears to us to be susceptible of improvement, and we specify in this connection the lack of feeling for the comfort of travelers while alighting from or taking trains in the average train shed, the matter of unnecessary ear-splitting noise from bells, and more especially the raucous exhaust from engines backing out after a completed run. These exhausts from small nozzles are excruciating to sensitive nerves, and have the effect of putting the strongest in a splenetic mood, and are all the more exasperating from the fact that the perpetrators of the outrage cannot dig up the shadow of an excuse for it. Roads that have a proper care for the comfort of their patrons muffle the exhausts of their engines while in train sheds, and since there are not many yet on record, it is fair to assume that the public does receive the consideration it deserves in this regard.

Locomotive Engineering has secured possession of four volumes that contain copies of all the drawings of railway appliances collected by Major Pangborn in connection with the World's Columbia Exposition. It is the most valuable collection of drawings and engravings illustrating railroad development to be found anywhere outside of the Field Columbian Museum. Strangely enough, the early volumes of Locomotive Engineering were drawn upon more than the pages of any one other publication for historical locomotives and cars, so it is very proper that it should become possessor of the whole collection.

There is an absurd idea entertained by many railroad men that an injector will not work if the check valve is above the water line. It is all right, and perhaps fortunate, that many enginemen believe that a check valve is more difficult to raise with 150 pounds of steam applied direct than it is with 150 pounds pressing through water, but it implies very poor reasoning faculties. It is on a par with the idea that a pound of milk is heavier than a pound of water.

We have received, through the personal kindness of Mr. Moseley, secretary of the Interstate Commission, a copy of the report prepared by the United States Government on "Power and Machinery Employed in Manufactures," embracing statistics of steam and water power used in the manufacture of iron and steel, machine tools and wood-working machinery, wool and silk machinery, and monographs on pumps and pumping engines, manufacture of engines and boilers, marine engines and steam vessels, by Prof. W. P. Trowbridge. It is a little out of date now, having been compiled in 1888, but it still contains a great deal of valuable information.

The Finns possess a fishy name and attributes hitherto more or less obscure, but the fact that they are importing twenty-two American locomotives as a part of the equipment of the Finland railway system shows that they are waking up and practicing the goose step, preparatory to falling into line in the march of the world's advancement. It is creditable to the waxing enterprise of that remote, unfriended, solitary but not entirely slow region that it knows where to find the best railway material and is not willing to lag behind still more distant countries like Corea and Manchuria, where in no long time the whistle of the American locomotive will be louder in the land than its many gongs and trumpet forth a much higher note of progress.

The Falls Hollow Staybolt Company have decided to manufacture solid staybolt iron in addition to their well-known hollow iron, so as to be able to supply both kinds. This will be of the same high grade quality as their other staybolt iron. We have received several specimens of their solid staybolt iron fractured in a testing machine, and it looks a material that will stand lots of hard usage.

PERSONAL.

Mr. W. T. Godfrey, master mechanic of the Salt Lake & Oregon, has resigned.

Mr. John McGuire has been appointed general superintendent of the Astoria & Columbia River at Astoria, O.

Mr. James Hickey has been appointed master mechanic of the Gulf & Interstate, with headquarters at Beaumont, Texas.

Mr. W. N. Cox has been appointed road foreman of engines of the Alabama Great Southern, with headquarters at Birmingham, Ala.

Mr. James M. Kirk has been appointed master mechanic of the Salt Lake & Ogden at Salt Lake City, Utah, vice Mr. Godfrey, resigned.

Mr. James A. Corey, locomotive engineer on the Boston & Maine, has been appointed master mechanic of the shops at Portsmouth, N. H.

Mr. H. S. Spangler has been appointed general superintendent and auditor of the Gulf & Interstate Railway, with headquarters at Galveston, Texas.

Mr. J. H. Crawford, general agent of the Lackawanna line, has been appointed manager, with headquarters at Buffalo, N. Y., vice Mr. W. H. Smith.

Mr. W. H. Hooper has been appointed general agent of the Safety Car Heating & Lighting Company in Chicago, Ill., vice Mr. Geo. N. Terry, resigned.

Mr. P. Nolan has been appointed superintendent of the Cascade division of the Great Northern at Leavenworth, Wash., vice Mr. J. W. Donovan, resigned.

Mr. J. A. Edwards, general foreman of the Rio Grande Southern at Ridgway, Col., has been appointed master mechanic, with headquarters at Ridgway, Col.

Mr. E. L. Moser, mechanical engineer of the Philadelphia & Reading shops at Reading, Pa., has accepted a position with the Baldwin Locomotive Works.

Mr. L. S. Miller, assistant general manager of the St. Paul & Duluth, has been appointed general manager of the Seattle & International, with headquarters at Seattle, Wash.

Mr. Robert H. Sayre, second vice-president of the Lehigh Valley, has been appointed assistant to the president, and is succeeded by Mr. J. B. Garrett, third vice-president.

Mr. E. E. Rittenhouse, formerly superintendent of the Midland Terminal Railway, has gone to Corea to take charge of the railroad which Mr. H. Collbran is building there.

Mr. S. W. Simon, formerly with the Boston & Maine, has been appointed road foreman of engines of the Shamokin division of the Philadelphia & Reading at Tamaqua, Pa.

Mr. O. O. Winter has been appointed trainmaster of the Radford division of the Norfolk & Western. He was formerly assistant general superintendent of the Great Northern.

Mr. J. C. Stuart, superintendent of the Chicago & Northwestern, has been appointed general superintendent of the Chicago, St. Paul, Minneapolis & Omaha branch of that road.

Mr. H. H. Vaughan has been appointed mechanical engineer of the Philadelphia & Reading shops at Reading, Pa. Mr. Vaughan was formerly mechanical engineer of the Great Northern.

Mr. A. D. McCollum has been appointed master mechanic of the Cincinnati, Hamilton & Indianapolis division of the Cincinnati, Hamilton & Dayton; headquarters at Hamilton, O.

Mr. W. E. Morse has been promoted from assistant superintendent of the Madison division to superintendent of the Galena division of the Chicago & Northwestern; headquarters at Chicago.

Mr. F. B. Henretta has resigned as foreman of the "Big Four" roundhouse at Linndale, O., to accept the position of road foreman of engines of the Radford division of the Norfolk & Western at Roanoke, Va.

Mr. James M. Percy, formerly master mechanic of the Cincinnati, Hamilton & Dayton, has been appointed master mechanic of the St. Louis division of the Baltimore & Ohio, with headquarters at East St. Louis.

Mr. T. O. Wood, general storekeeper of the Gulf, Colorado & Santa Fé, has been promoted to the position of purchasing agent of that road, vice Mr. W. E. Hodges, resigned; headquarters at Galveston, Texas.

Mr. Samuel Porcher, assistant purchasing agent of the Pennsylvania Railroad, has been promoted to the position of purchasing agent, taking the place left vacant by the death of A. W. Sumner; headquarters, Philadelphia, Pa.

Mr. R. E. State, for the past four years air-brake machinist of the Bellefontaine shops of the "Big Four," has been promoted to the position of foreman of the Linndale roundhouse of that road, with headquarters at Cleveland, O.

The following changes have been made on the Pittsburg & Lake Erie: Mr. J. M. Schoonmaker has been elected vice-president and general manager, Mr. G. M. Beach has been made assistant general manager, and Mr. J. B. Yohe, general superintendent.

Our correspondent, Mr. H. Rolfe, of Scranton, Pa., has been appointed professor of steam engineering courses of the International Correspondence School, of Scranton. We believe that a very judicious selection has been made for that position.

Mr. James M. McCrea, First Vice-President of the Pennsylvania, west of Pittsburg, who has been elected a trustee of the University of Pennsylvania, is the first person not a resident of Philadelphia to be so elected, and the new departure probably indicates a desire on the part of the University to enlist the interest of the whole State. If the Board of Trustees is suffering from deficiency of energy Mr. McCrea will carry in a liberal supply.

Mr. L. R. Pomeroy, sales agent of the forge department, Cambria Iron Works, recently treated the senior students in mechanical engineering of Purdue University to an excellent description of the character and significance of the "Coffin process," as employed by the Cambria Company. The lecture was illustrated by means of charts and diagrams, and was an interesting presentation of the process employed in producing axles, crank pins and similar forgings by the Cambria Company.

Several important changes have been made in the traffic department of the Baltimore & Ohio Railroad. J. A. Murray, heretofore coal and coke agent, has been given the title of general coal and coke agent of the entire system, with headquarters at Baltimore. William L. Andrews has been appointed assistant coal and coke agent for the Pittsburg district, with headquarters at Pittsburg. E. T. Affleck, heretofore coal and coke agent for the lines west of the Ohio River, with headquarters at Columbus, has become assistant coal and coke agent for that territory.

Abner C. Goodell, of Salem, Mass., who has just celebrated his ninety-third birthday, is said to have perfected the design of the first printing press which printed on both sides of a paper at once, and he also discovered the process for preparing steel and copper plates for engravers. Later he helped build the first locomotive for the Boston & Lowell Railway, and turned the wheels of the first turntable. He worked on the first electric motor ever constructed, which afterward ran between Baltimore and Washington, and on the first engine lathe for the Eastern Railroad repair shops.

Mr. Henry W. Johns, who was well known as the pioneer of the asbestos industry, was born in West Stockbridge, Mass., in 1837, but came to New York city at an early age. While experimenting with fireproof compounds in 1858, he became acquainted with asbestos and its peculiar qualities, and from that time until his death, on February 8th, he worked steadily and continuously toward the development of this substance for commercial uses. His many inventions have helped to make it a success, and the well-known company which bears his name is a testimonial to his industry and perseverance.

Time to Take to the Woods.

A correspondent of *The Locomotive* relates the following incident:

"I was called upon to go out into the country for a few miles, to look at a boiler which 'had not exactly burst,' but had pulled the flues out of one of the flue sheets. Upon examination, I found that the flue sheet in the firebox had bent outward so as to drop all of the middle rows of tubes into the boiler, only the upper row and the bottom ones remaining in place. The crown sheet was blistered in several places, and showed four small cracks from 2 to 5 inches long. The gage cocks in the front of the boiler were in bad condition, and the lower ones were useless.

"The water column on the side was connected to the boiler, top and bottom, by pipes which were each fitted with a globe valve. The steam gage was slow, and the safety valve had various monkey wrenches and plow bolts hung upon it. The boiler was fed by an inspirator, which appeared to be in good working order.

"Upon making inquiries, I found that the boiler had run all right the day before, and the fireman and sawyer (for it was a saw-mill) both asserted that there was plenty of water in the boiler when they quit work the night before. When the mill was well under way on the morning of the accident, the fireman approached the sawyer and said: 'I wish you'd look in here; the steam is right blue.' The sawyer did as requested.

"The water in the glass appeared to be all right, but upon looking into the firebox he said it 'looked red.' Feeling uncertain what was going to happen, the men shut off the steam, and precipitately 'took to the woods,' and the boiler soon gave way, in the manner indicated above. It seems that someone, whether maliciously or not, had shut off both the globe valves leading to the water column, so that although there was no water in the boiler, there was plenty of it in the glass gage, and the shortage was not detected, because they did not use the gage cocks. The boiler was repaired, and is now doing good service again."

It Killed Him.

"Speaking of passes," said an old legislator, "I recall once, when all of us were given an annual pass and our demands for passes for relatives were honored, how a member made the most of the privilege.

"He wrote a short note to the Central's Albany agent demanding a pass for himself and wife and two children over all lines from Albany to Los Angeles, Cal. Not receiving the passes as soon as he expected them, he wrote another letter declaring that he wanted those passes at once and no fooling about it, as he wished to use them now, not six months hence. For some reason his demand was honored, and he received the passes. Was he astonished or grateful? Not a bit. He held them for a week, and then sent them back with a note which read: 'Have these passes indorsed good for berths and meals.' The Albany agent duly transmitted the communcation to President Depew's private secretary. The member waited a while, and then he went for the Albany agent, who could only answer that he had duly dispatched the passes to headquarters. Another wait and then another wrathful demand from the new member for his passes. The Albany agent, to rid himself of the annoyance, sent a letter to headquarters detailing the new member's persistent demands. He received a reply which he duly turned over to his tormentor. It read: 'The man who opened that —— letter and read it fell dead, and no one can be induced to pick it up to see what it contains.'"

Plain Talks on the Injector—III.

By Fred H. Colvin.

CAPACITY.

The capacity of an injector depends on the steam pressure, the hight of lift and the temperature of the feed water. The higher the pressure the more steam flows through the steam tube per second and the more water is required to condense it, the same as any condenser. So high steam adds to the capacity of the injector, within certain limits, providing, of course, the tubes are properly proportioned. The hight of lift affects capacity simply because it adds more work for the steam jet to do. The higher the lift the less the capacity.

Temperature affects the capacity by increasing the volume of the same weight of water. The condensing capacity of water depends both on its weight and temperature, and the higher the steam, the colder the water should be, or else more is required in proportion to the steam pressure.

The exact effect of temperature and lift is not easy to arrive at, but a few figures from experiments of different makers may be interesting, and they are given below.

Sizes must not be considered, simply the comparative capacity at the different temperatures. The effect of various lifts is not easy to obtain and there is an insufficient amount of facts to be had on this subject.

Tests of a Re-starting Injector—Steam, 80 Pounds; Lift, 5 Feet.

Supply, 65 degrees; capacity, 386 gallons per hour.

Supply, 100 degrees; capacity, 347 gallons per hour.

Supply, 120 degrees; capacity, 309 gallons per hour.

Tests of a Locomotive Injector—Steam, 120 Pounds; Lift, 1 Foot.

Supply, 65 degrees; capacity, 1,287.5 gallons per hour.

Supply, 100 degrees; capacity, 1,080 gallons per hour.

Supply, 120 degrees; capacity, 960 gallons per hour.

Supply, 135 degrees; capacity, 825 gallons per hour.

Varying the hight of lift with the first injector gave the following results:

Lift, 5 feet; capacity, 386 gallons per hour.

Lift, 10 feet; capacity 331 gallons per hour.

Lift, 15 feet; capacity, 257 gallons per hour.

These are probably fair averages for the effect on capacity, and show clearly how surely the heating of feed water and the increase of lift affect the capacity of an injector. The effect of steam pressure is to increase the capacity up to a limit, then to decrease it. This limit depends on the injector and the design of its tubes.

LOCOMOTIVE INJECTORS.

While there is practically no difference between locomotive and stationary injectors, the former are generally of a distinct form, which has been adopted after various experiments by different makers. They are, as a rule, lifting injectors with the lifting jet combined in the body of the injector, and the later models operate the jet with the first movement of the steam valve stem.

As the lift is comparatively low, they do not often give trouble, but the writer prefers the non-lifter, of the fixed tube type, which is placed below the level of the tank and does away with the necessity of the lifting jet.

Some of these have an overflow valve, which has to be closed after the injector is started, or when it is not working, and if this is not done, all the water may escape from the tank. This has been done in some instances and has rather thrown the non-lifter into disrepute for locomotive use.

It has been proposed, and put into practice by at least one firm, to put the overflow in the cab as with the lifting injector, so that the engineer can see the overflow and also that the water cannot run out of the tank, as the overflow is higher than the water level in the tank.

The injector is thus always primed, and as soon as steam is turned on there is no difference in action from those having the overflow at the injector.

Aside from the impossibility of draining the tank, there is also much less difficulty with the "liming up" of the tubes, as deposits of lime or similar substances are called. This is because the tubes are always flooded with water, which does not allow of the deposits, as in the injector which is not submerged. In this case the water leaves the injector as soon as it is shut off, the injector heats up from the steam, and the lime in the water is baked solidly onto the tube. This being continued gradually fills up the tube, reduces the capacity of the injector and finally prevents it from working properly.

The time necessary for this filling up depends on the water, some waters filling a tube in three months, others not in twenty years, and still others eating the tube rather than making any deposit.

Some makers recommend a solution of 1 part muriatic acid to 10 parts of water as a bath for soaking the tubes in to soften and remove the scale or deposit. While this is effective in many cases, it must not be considered as a panacea for all ills of the kind, for some deposits seem to yield only to forcible removal.

DISEASES AND THEIR SYMPTOMS.

It is probably the most natural thing in the world for a person to blame the machine or instrument in case it doesn't work to perfection, and instead of looking for defects in the surroundings, the maker usually gets a telegram to "send a man right away, as the injector is no good." This is especially true if there is any doubt as to the reliability of the instrument and is aided by the tales of failure told by rival salesmen.

It is cheaper, and saves much humiliation at times, to look over the surroundings carefully and see if you cannot discover the cause of failure. If it is a new injector just put up, be sure all directions for piping have been followed, as well as any hints in the maker's catalog.

The first intimation that anything is wrong is usually a refusal to go to work or a "break" after being started. There are no rules which will give an infallible answer as to the cause of any symptom which appears, but a few hints and examples, taken from a number of years' experience in testing and looking after the diseases of injectors as a sort of "trouble man," should help a little.

When an injector does not readily "take up" the water, or start after the water is flowing through it, it is pretty good evidence that there is not steam enough, or that it has not force enough to put the water into the boiler.

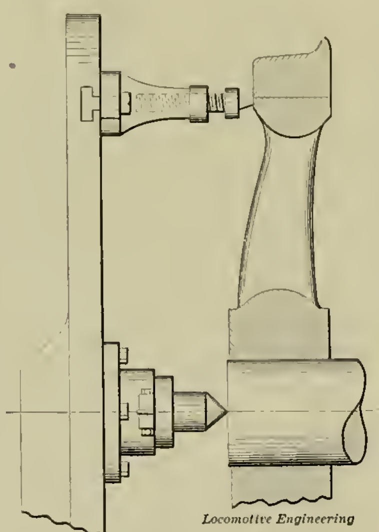
This may be due to steam pressure being too low for the injector, or to a restricted steam pipe due to something getting in pipe. (If this is the case, it will probably be found that the valve disk has worked off the stem and does not give a full opening.) The steam tube may possibly be obstructed, or the discharge tube worn so large that the proper proportion is destroyed and a new tube or a set of tubes in order.

This is very seldom the case, except with very bad water that has a chemical action on the tubes and eats them away rapidly. There are places where a set of tubes will hardly last six months, and others where they have been in use twenty years without repairs.

The most trouble, however, comes from an insufficient or irregular water supply, which at times causes peculiar action on the part of the injector. If the water supply is sufficient but irregular, a restarting injector is probably the best, as it will go to work automatically as soon as either the water or steam is again supplied to it. This is often necessary in the case with traction engines and yachts.

If the injector does not start readily, but heats up, and steam blows through, it indicates little or no water, although tubes which are worn beyond the working limit will refuse to work under any conditions. This, however, can be readily ascertained by examination, and is not very likely to be the case, as worn tubes always give warning by improper working, such as wasting at overflow and breaking with slighter variations in pressure before it absolutely refuses to do its duty.

It is an easy matter to test the water



DRIVING-WHEEL LATHE.

supply to see if it is sufficient; and if the injector starts, or attempts to start but breaks immediately, it is time to do this. Simply let the water run through the injector and measure the quantity flowing through in one minute. This can be readily measured in an ordinary pail or bucket (according to which part of the country you are in) by remembering that they hold a little over 2 gallons on the average. Knowing the capacity of your injector in gallons per hour, divide this by 60 for the quantity per minute, or multiply the measured quantity by 60 for gallons per hour, and see whether there is enough to feed the injector. One who is accustomed to it can usually tell pretty near by the size of stream coming out of overflow; but it is safer to measure it, as sometimes it is deceptive.

Stretching the Truth.

"Talking about liars," said John Alexander, "all men are liars; only, some have gone up to the thirty-third degree, while others are contented with the third degree.

"Away back in '78 (I was mighty nearly saying '58), I was performing as roundhouse foreman and had occasion one night to hustle around for an extra fireman for an express train. The only material available was a young fellow, recently employed, who was on a switch engine. He had a couple of years' experience on others roads, I believe. His head was a small collection of other little accessories attached to a large bump of talkativeness. The engineer was the oldest on the road, ran the first engine, a deacon in the church and a good man. Old Frank would no more knowingly tell a lie than fly; but, like all other railroaders, his memory of dates was a little offish, and about twice a year some of the older citizens had to tell him that it was the charter the company got in 1835, and not the first engine, which came in 1847.

"Well, the next night the express came in on time, and as Old Frank put his finger prints and name on the register, I asked him how that young fellow had done.

"'Young feller?' says he, with a pitiful look at me, 'young feller?—why, John, that man has fired for two years on every road in North America, some on most of 'em in South America and all the principal ones in Europe, Asia and Australia. Young feller? Why, man, he's a hundred and ninety years old, according to his own figgers. Don't call him a young feller.'"

How the Output of a Driving Wheel Lathe was Increased.

At the Panhandle Shops, Indianapolis, Ind., the average cost of turning tires, under the piece-work basis, was $3.25, and the lathe was taxed to the utmost to keep up to the work; whereupon Mr. Swanston, the master mechanic, arranged three jacks, to be applied to the faceplates (see sketch). These jacks are bolted through the radial slots of the faceplates, and can be readily adjusted to any size wheel. Near the top of the screw is a square shoulder, where by means of a wrench the screw can be advanced and made to bear on the rims of the drivers, just under the tire. These jacks so steady the work that the time of turning is reduced from 11½ to 5½ hours; the cost, from $3.25 to $1.75. The feed was advanced from a scant 1-16 inch to 7-32 inch and the cut correspondingly.

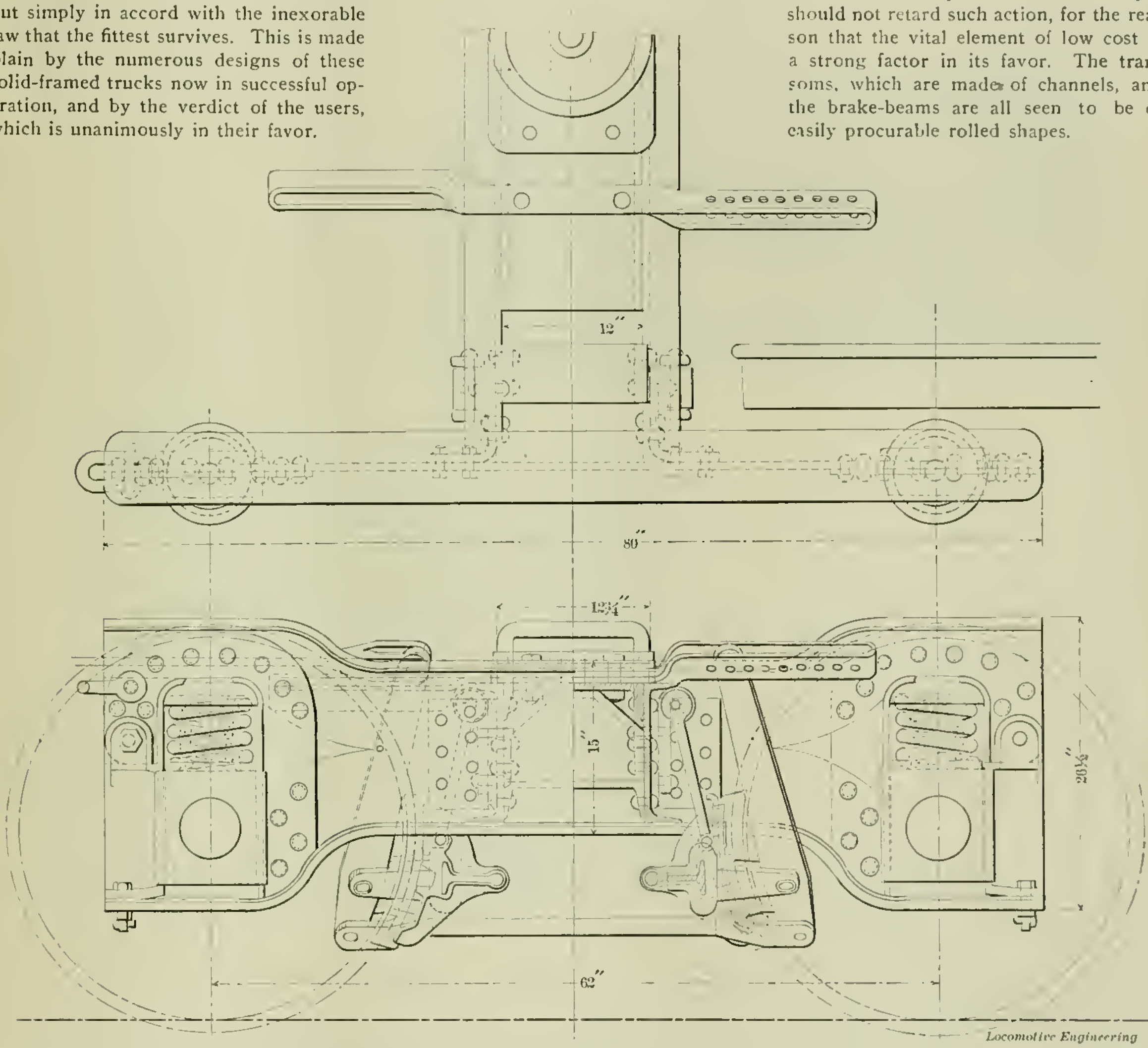
Instructions have been given on the Panhandle that empty flat cars must be hauled next to the caboose no matter what their destination may be, as a measure of safety in preventing their collapse in the middle of a train.

Car Department.

CONDUCTED BY O. H. REYNOLDS.

The Joughins Steel Truck.

There is no longer any question that the solid metal frame truck will ultimately supplant the arch-bar type of frame, and this will come about, not from any apathy displayed by the exponents of the latter, but simply in accord with the inexorable law that the fittest survives. This is made plain by the numerous designs of these solid-framed trucks now in successful operation, and by the verdict of the users, which is unanimously in their favor.



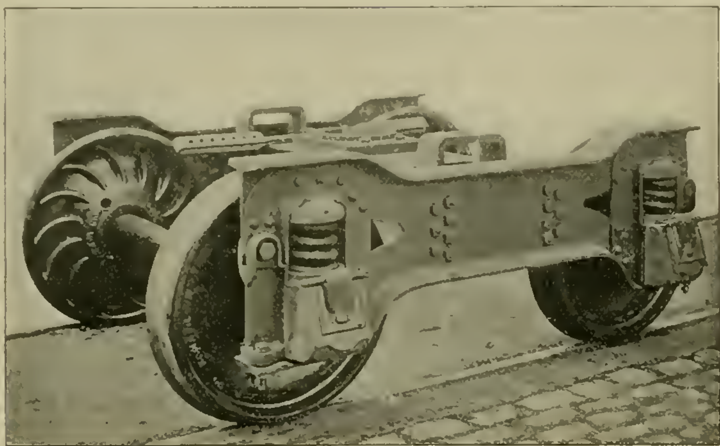
THE JOUGHINS STEEL TRUCK—DETAILS.

Among the best of these is the production of Mr. G. R. Joughins, superintendent of motive power of the Norfolk & Southern Railroad, who was one of the first in the field of steel-car design, with a car which is still in service. It is but a natural and fitting sequence that he should have devoted some thought to a steel truck, after his experience with a steel car, and was probably the first to propose a rolled-beam truck; it is certain, however, that his is the first truck built of rolled sections, and in use.

This truck is shown in our half-tone, and also in line engraving. It is seen that the whole frame is composed of standard rolled shapes. The side frames are made of 15-inch I-beams, which are cut out at the ends and bent both ways to form the jaws; the latter are then reinforced to receive the boxes and springs. The strong point of the truck is the hinged jaw which is pivoted and bolted at the outer end of the frame to facilitate the removal of a pair of wheels.

This improvement in trucks of this type removes a very serious objection—in fact, it has been the stock grievance entertained by its opponents. It is now possible to remove or replace a pair of wheels fully as quick, if not quicker, by means of this hinged jaw, than can be done with the arch-bar truck. If the steel truck is to become a permanent fixture, as we believe it will, this improved jaw is one of the features that will insure its early adoption, and the adaptation of rolled shapes should not retard such action, for the reason that the vital element of low cost is a strong factor in its favor. The transoms, which are made of channels, and the brake-beams are all seen to be of easily procurable rolled shapes.

This truck has now been in service over two years, and has not shown a weak point, in the hardest trials a truck can be subjected to. There is no doubt that it will hold its own in the battle for supremacy now waging between the several kinds of the solid-frame truck, because it is a mechanical production designed by a practical man who has the courage to put his ideas in practice on his own road, and thus stand or fall by the record, not asking the good opinion of the mechanical public until he has earned the right to do so by works. The details of construction show how this has been accomplished for cars and tenders, in the case under discussion, but do not show later improvements (proposed) of the side girder, nor of a lock bolt on the hinged jaws, all of which are covered in the patent claims.



THE JOUGHINS STEEL TRUCK.

Car Equipment on the Long Island Railroad.

Superintendent of Motive Power Prince is at this time engaged in making extensive improvements in his passenger train cars, putting them in line with the best rolling stock by the application of the latest and best improvements. The winter season furnishes the required opportunity to reach an equipment that cannot be touched in the summer, and the most is being made of the opening.

Pintsch gas is the light being put in everything, and the Standard coupler is being applied as fast as practicable to reach the cars, and also to tenders. This coupler is the standard in a double sense, having been adapted as such by the road. The Standard Coupler Company's steel platform is having an inning here also, they taking the place of all platforms requiring renewals and for all new work. The shops are full of business in consequence of these betterments of rolling equipment, and the alteration of ten combination cars into straight baggage cars.

The company are having built for spring delivery, twenty combination cars by the Pullman Palace Car Company. The particulars of construction and finish are given in the specification herewith:

Length over end sills—57 feet 6 inches.

Width over end sills—9 feet 8 inches.

Hight from top of rail to top of deck roof—13 feet 6½ inches.

Baggage compartment—21 feet long.

Platform to be Sessions' steel, as manufactured by the Standard Coupler Company, including iron body bolster.

Couplers—M. C. B. type, as manufactured by the Standard Coupler Company.

Brakes — Westinghouse quick-acting automatic, with conductor's valve spring pattern operative throughout car; L. I. R. R. standard.

Westinghouse air train signals.

Heating—"N. Y. Safety" system, direct steam; all pipes covered with approved sectional asbestos covering.

Seats—Ten to be equipped with Hale & Kilburn "Walkover" seats, with adjustable foot-rests, and ten to be equipped with the Pottier & Stymus Company's standard car seats, with adjustable foot-rests.

Shades—Of Pantasote material.

Lighting to be Pintsch gas system of five lamps; three in passenger compartment and two in baggage compartment.

Basket racks—L. I. R. R. standard.

Adams & Westlake's protection dry closet, No. 15.

Interior finish of passenger compartment to be quartered oak and lamps, racks and hardware to be of yellow brass. Interior finish of baggage compartment to be whitewood sheathing, to be painted a buff color.

Wheels to be Taylor steel tired, 36 inches diameter.

Axles—New M. C. B. standard, 4¼ x 8 inches; journals, of Cambria Iron Company's "Coffin" toughened steel.

In addition to the above in the way of new equipment, the Pullman Company are building one mail and express car, 60 feet 11¾ inches long over end sills and 9 feet 6¼ inches over side sills, with a mail compartment 20 feet long. The platforms, couplers, brake, steam heat, light and wheels and axles are the same as for the combination cars. The interior finish of this car will be of whitewood throughout; the express compartment to be painted a buff color, and the mail compartment fitted up complete in every essential according to the United States Mail Service's most recent specification and drawings, and with Ayars mail catcher attachment.

Private Car of the International Correspondence School.

One of the best evidences, that push means success is shown in the last business move of the International Correspondence School, of Scranton, Pa., who have had a car built for their use to carry their name and methods to all the cities of the land, and give employers and employés an object lesson in the correspondence system of education as practiced at their famous institution.

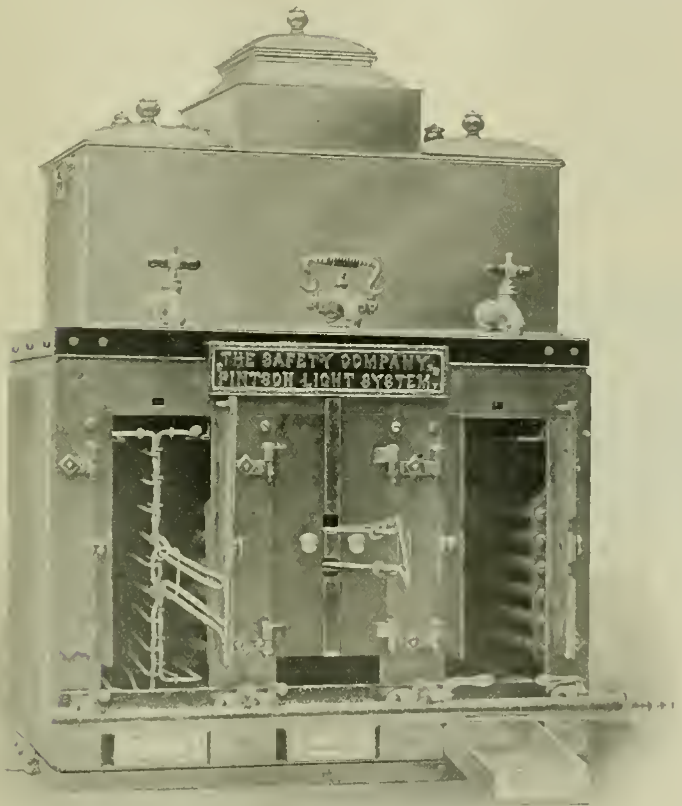
The car was built by the Jackson & Sharp Car Company, of Wilmington, Delaware, on designs best calculated for the purpose of handling the instruction equipment, and at the same time make a comfortable home for the corps of attaches accompanying it. The car body is 50 feet long, and 9 feet 8 inches wide, with a reception room 18 feet long finished in quartered oak and fitted with all appointments found in a modern room of the kind. The sleeping accommodations consist of four sections, thus taking care of eight people. There is a storage room, 14 feet 6 inches long, for carrying books, and in this room are lockers for clothing and stowing away various supplies. At the opposite end of the car are located the saloon and toilet arrangements, together with the Baker heater and storage of linens.

In all particulars the car is gotten up in the highest style of private car work, and is in all respects worthy of the cause to which it is to be devoted. It is handsomely painted a "Brewster" green, with gold-leaf decorations. Along the letter board runs the legend: "Established 1891—Industrial Science Taught by Mail—Established 1891," while below the windows is inscribed: "Correspondence Schools, Scranton, Pa." This is certainly a clever idea, and will prove a remunerative one to the school, that deserves the prosperity they have worked so hard to attain.

The Erie Railroad Company have built a dynamometer car, and pronounce it a good thing with which to probe for train resistances. This adjunct to the appliances of precision, is assumed in most cases to stand in the light of a luxury rather than an instrument that has possibilities within itself to be a money-earner, and therefore as much a necessity as any other investment that will open up channels to increased earnings. We have noted, and it is a peculiar fact, that it is only the most progressive roads that fail to see how money is wasted in such an investment.

New Broiler for Cafe Car.

The broiler shown has been designed and put upon the market by the Safety Car Heating and Lighting Company, and is heated by the burning of Pintsch gas. It is a remarkably compact and convenient apparatus, and as it serves as a base for the regulation buffet urn, no more room is required in the buffet compartment than was taken up before by the ornamental but useless urn base, or in other words the designers have made such good use of heretofore unused space in the crowded buffet compartment that the capacity of the ordinary buffet cars has been added to three or four-fold, and they have been made almost equal in point of service and satisfaction to the passengers to one of the regular dining cars.



GAS BROILER.

When this design was being worked upon it was decided to make the broiling compartments vertical in form, primarily to save space, and this end has been successfully achieved. In addition, this style of broiler admits of the use of flame on both sides of the compartment, and this results in ability to serve any of the articles to be cooked more satisfactory than on either a horizontal gas broiler or an ordinary coal stove, for the reason that the meat is browned simultaneously on both sides, and this prevents the drying out process that is often effected in attempts to broil.

The New York, New Haven & Hartford Railroad have about twenty-five of these broilers in use, and it is said that their introduction has caused more favorable comment among travelers than anything that has been done in the passenger department for some time. Mr. Crane, superintendent of drawing room and dining car department is very much delighted with them.

An item in a New England paper says: "The New York, New Haven & Hartford Railroad should be congratulated upon the success achieved through the introduction of gas broilers upon its buffet cars. The broilers have proved a boon to travelers, for it is no longer necessary to serve a luncheon from a menu consisting largely of canned goods; as at the present time, on all the drawing room cars of the express trains leaving Park Square Station in Boston for New York, excepting the 5 p. m. and midnight trains, passengers may be supplied with steaks, chops or broiled chicken, with all the accessories, in a manner superior to the service of many hotels.

"The gas broiler is a very ingenious appliance, compact in form and occupying very little space in the buffet compartment, while its capacity is relatively exceeding large, so that a half dozen orders may be filled by it at one and the same time and with corresponding rapidity."

Delaware, Lackawanna & Western Car Shops, Dover, N. J.

The shops at Dover are devoted exclusively to car work, and located on the Morris & Essex division of the road, embracing all branches of car details from light repairs to new work; the equipment is therefore one adapted to both freight and passenger car construction. Like all shops that have felt the necessity of branching out to provide for increased calls on its capacity, these are made up of new and old structures, and in consequence have a home-like appearance to the old-time shop man. In strict accord with the policy of the "Lackawanna" to make a show down for the expenditure of a dollar, there are no frills visible about the plant, every tool and man apparently filling a place to supply a need.

In the blacksmith shop Master of Car Repairs Baker pointed out a fine collection of dies for the Bradley hammer, and also for the steam hammers. These dies are very complete for the lighter class of die work and bear witness to an effort to bring shop methods up to a modern standard. Considerable attention has been given to air appliances about the shops, lifts being freely distributed, especially at the machine shop tools. A system of air pipes also extends through the yards for testing purposes; the air being compressed by Westinghouse pumps. The system covers quite an extent for pumps to supply, but they are equal to it.

Some new vestibuled coaches have been turned out recently at a cost highly favorable to the plant. A new combination baggage and smoking car just run out of the shop, had an interior finish of oak, with seats of Pantasote, the car presenting a very neat appearance—too neat for a commuter to defile. The new gondolas under various stages of completion gave evidence of equally good work in their line—plain, square work for freight service, which does not mean sandpaper on the coal sides, but of the quality known to the car man as "good enough," which, reduced to its lowest terms, indicates that no appreciable waste of wealth has taken place to get results; all of which appears to be directly in line with dividend getting, a science fully understood by the management of this road.

Admirable facilities for storing and seasoning lumber have been arranged for in the yards, and in connection with a first-class brick dry-kiln, the latter of which was unfortunately burned recently. There were no waits necessary for dry stuff. The fire was one of those mysterious spontaneous affairs that left nothing but the walls of the kiln, which contained at the time 85,000 feet of pine and white wood. This charge had been subjected to a temperature of 90 degrees for about eight days, when it took fire and was wiped out. The word "mysterious" seems almost a misnomer to use in connection with long-continued heat and inflammable elements such as are present in pine; but it is a fact that the resulting combustion is not satisfactorily explained. The kiln is being rebuilt, and will soon be as good as before the "visitation" of the fire fiend.

The Brill Combination Construction Car and Snow Plow.

The J. B. Brill Company have recently built a special form of car for the Lorain & Cleveland Railroad Company, which from its convenience and the fact that it may be utilized in case of necessity as a snow plough, makes it worthy of especial attention. The body of the car is that used in the ordinary type of construction cars for suburban roads. It is mounted on a pair of "perfect trucks," Brill No. 27. At the forward end is placed a vestibule enclosed on all sides and fitted with drop sash. A canopy, carrying the trolley board, extends over the whole car. The length of the body is 24 feet; width, 6 feet 1 inch. Sills are of yellow pine, plated, 3¾ x 7 inches. The plates are ⅝ x 8 inches. The stringers are 3½ x 7 inches, and the flooring 1¾-inch yellow pine. The sides are hinged, the hinges extending all the way across the sides, which are 24 inches high, and hinged in three sections; at the rear the end drops in a single piece. The car is fitted with four G. E. 57 motors, and electric brakes are fitted on the car. The wheel base of the trucks is 5 feet 9 inches. The wheels are 33 inches in diameter, and the gage is 4 feet 8½ inches. There are two truss rods to hold up the center of the body. As above described, the car is of the ordinary construction type; and for use in winter, a detachable nose plough with wings and fittings is provided, and in the center of the car a separate independent sand feed is arranged, and there are two sand boxes placed in the body of the car to be operated by hand. This arrangement of plough and wings is very effective, and as it can be removed when it is desired to use the car for construction purposes, makes it especially valuable. The large boxes in the center of the car are used for hauling salt or sand. There is an alarm gong and plain arched roof. The car is provided with curtains, so that the sides can be closed in case of necessity.

THE BRILL COMBINATION CAR.

Copper Sheathed Coach—New York, New Haven & Hartford Railroad.

In the month of January, 1897, we were invited to inspect a copper-sheathed passenger car, just put in commission on the New York, New Haven & Hartford Railroad. The general features of the new system of sheathing represented by the car were explained at that time by Mr. Appleyard, the master car-builder of the road, who prophesied some savings to the company in cost of maintenance, the particulars of which appeared in this paper, together with the method of application of the sheathing.

After the lapse of one year, in which the car has been in constant service, it has more than fulfilled all expectations with reference to appearance, and presents to-day as bright and clean an exterior as it had on the day of entering on its duties. We understand the company is so well pleased with the results of the venture, that they will sheath one car with aluminum bronze and one with aluminum, in order to find their respective wearing qualities and the cost of cleaning, together with a comparison of first and subsequent expense with the car under discussion. The copper sheathing was shown at the Old Point Comfort convention of the Master Car Builders, and excited considerable favorable comment, which has proved to be justified in the light of the flattering reports received of its performance.

The Gilderfluke Coupler.

BY ELI GILDERFLUKE.

In the balmy spring of 1620, my friend Otto von Guericke, of Magdeburg, Prussia, the inventor of the air pump, the left-handed Stillson wrench, the fore and aft hydrostatic paradox, and publisher of "Experimenta Nova," remarked to me, "Gilderfluke, old man, why don't you invent something? Here's a whole raft of people inventing all sorts of things and gaining many a copeck thereby. There's Clonikiety, of Delancey street, with his patent double and twisted reversible scoop for shovelling fog off of the East River, rolling in wealth, eating three times daily at 'Beefsteak John's,' and no meal costing him less than 15 cents. Then there's Baptiste Parlezvou, of Paris (Ky.), the patentee and manufacturer of the celebrated gutta-percha 'spaghetti Italienne,' for use in 35-cent table de hôte dinners (wine included), got money to burn in a Wootten firebox, and they are not the only canaries on the perch; there are other inventors of equally meritorious articles, making money until they have insomnia. Gilderfluke, you're wasting good time by not inventing something, and I'll bet three round shekels against an apple-pie that you'll be hopelessly lost in the shuffle if you don't get a quick stir on."

"But, my dear man, what'll I invent?" I replied.

"Say, Gilderfluke," he answered, "you sure enough make me ache; a man of your tonnage and ability asking such fool questions. What'll you invent? Invent acetylene gas, non-kneebagable two-dollar trousers, flying machines—any old thing; but invent something."

After a slight pause he went on to say:

"Gilderfluke, me boy, in the course of one or two hundred years some slick commuter will invent railroads, having one smoking car for 700 passengers who would like to smoke and read on their way to business.

"There'll be railroads from Weehawken to Saugerties, and from Hoboken to Brick Church, stopping at Newark.

"These railroads will use freight cars of 60,000 pounds capacity, with pressed-steel trucks, steel-tired wheels, and be equipped with a quick-acting automatic brake, which a man by the name of Westinghouse will invent.

"Now, all that will be needed to make these cars a howling success and to the Queen's taste, will be a coupler. If you start right now, you'll be at the first table in coupler invention, because in a few years there'll be 19,368 patents issued for couplers, but they'll all be M. C. B. standard.

"Now, the real pretty thing for you to do is to invent a coupler on boldly original lines, to the end that, in years to come, the name of Gilderfluke shall be blazoned on history's pages as one of the world's greatest benefactors."

Being greatly impressed with the advice of this worthy genius, he being onto his job, and believing that a coupler was really the thing needed, I set to work, and now take great pleasure in laying before you a brief description of the celebrated Gilderfluke vacuum coupler, now standard on the Trans-Patagonian Railway and the Northern Rapid Transit Company's railroad of Iceland.

Before entering into a description of this marvellous invention, I would call attention to the fact that in the making of this coupler the comfort and well-being of the trainman has been considered, first, last and all the time, he being deserving of better things than he usually gets.

Reference figures will be found on the accompanying illustration.

1 are hemispheres made of nob iron mixed with asbestos, cast flat, galvanized, and hammered into shape on a bulldozer by a process peculiar to the inventor. This metal has a mean tensile strength of 67,384, and is the only metal that will stand the impact of cars coming together at a speed of twenty-nine miles per hour without breakage.

In order to avoid marring the faces of the flanges of hemispheres by cars coming together at a high rate of speed, these faces are covered with 9 inches of sponge rubber, 27, very porous and elastic; this rubber takes up the shock, and when cars are coupled, is compressed to about 13-16 inch in thickness, making an absolutely airtight lock, and still being flexible enough to adapt itself to the motion of the train.

2 is an opening closed by an impedro valve, hinged to open outward, the pressure of the atmosphere keeping the valve closed when air is exhausted from the hemispheres. This orifice is for the introduction of a Dewflicker atmosphere syringe for exhausting the air.

The *modus operandi* of coupling is as follows: Train 174 is to take on a car load of balloons at Callicoon. The brakes are set on this car, so that the car will offer a resistance to the train when backed up against it. The train is run ahead over the switch far enough to get considerable motion when backing up. The harder the train is backed against the car, the tighter the coupling will hold, for this reason: When the cars come together the elasticity of the rubber flanges soften the impact and forces some of the air in the hemispheres out at the orifices 2; this produces a partial vacuum, enough to hold the car by the coupler until such time as the trainman finds it convenient to finish the coupling. When the spirit moves, he arrives with a paragon-frame coal-pick and a lead-pipe graft, pries open the impedro valve and inserts the Dewflicker syringe. With one trainman to operate the syringe and another to pour on ice-water lest the syringe get too hot and stick, five minutes' active pumping suffices to create an absolute vacuum with an atmospheric pressure on each hemisphere of 26,600 pounds.

After the vacuum is fully established, the syringe carefully wiped and replaced in syringe holder 19, the hinged locking devices 28 are screwed up tight and the car is coupled for keeps, or until further orders.

The syringe is made of hard rubber, nickel plated, covered with asbestos, and painted Nile green; is 37 inches long, 12 inches in diameter, and is an exhauster and compressor combined. All of the air exhausted from the coupler is held in the syringe and compressed to a pressure of 2,000 pounds. This compressed air is used to blow holes in railroad doughnuts, inflate fried pies and to spray thin chopped ham on sandwiches; this last method of filling railroad sandwiches being far superior to the old way of photographing the ham on to the bread, and is less expensive.

When in the course of human events it becomes necessary to drop fourteen out of twenty-two cars, to enable the "Flying Yankee" to reach Kennebunk ahead of the "Royal Vandyke Brown" construction train, running wild, the trainman unscrews the locking nuts 28, kicks down the handle of air inlet valve 3, thereby bu'sting the vacuum wide open, and behold! the car is uncoupled in less than eight minutes.

5 is a drip cock for carry off condensation without letting the air in and queering the vacuum. This is a very complex valve, and would need a great many illustrations to make its operations clear.

We have some samples of vacuums made by this coupler at our office, and believe they will stand comparisons with any other vacuums made. The name "Gilderfluke Improved Vacuum" is blown in each vacuum.

4 is a back-action pressure gage, to show how much air is not in the hemispheres; there being no vacuum gages that would serve the purpose.

6 and 7 are lower and upper carrier ribs of cast brass, highly polished, and brazed on to the hemispherical portion of the coupler. These ribs fit loosely around the reinforcing car frame and slide easily thereon; so that in the event of cars of different hights coming together, the couplers can be raised or lowered so that they will meet evenly. This is accomplished by the hand wim-wam 11, carrying a gear 10, working in rack 9.

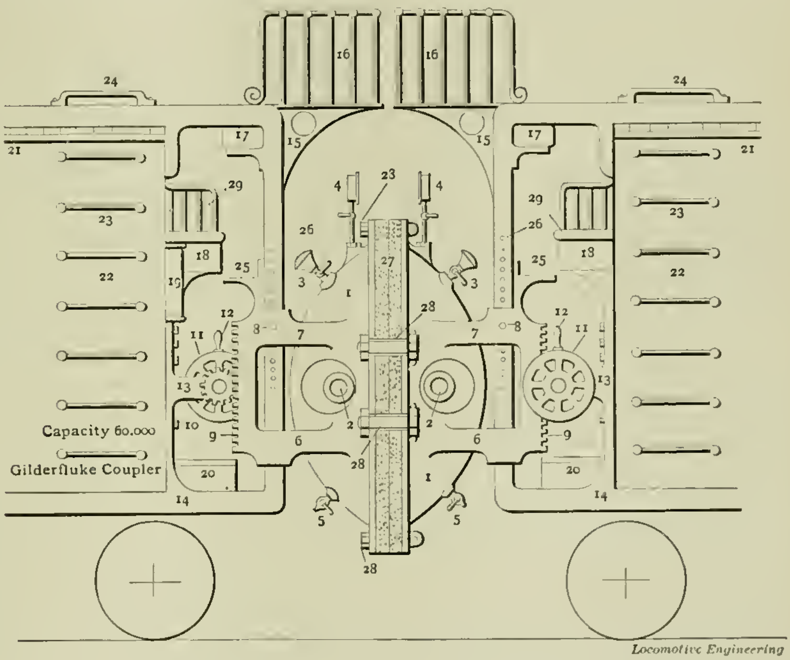
8 is a 3-16-inch hole in rib corresponding to a series of equidistant holes in the reinforcing frame 14.

When the coupler has been moved to the right position, a hollow staybolt is introduced through both rib and frame and securely locked on the other side by a split pin. These split pins are furnished the trainmen by the gross, and are to be carried in his vest pocket, ready for instant use, should they be lost out of the staybolt from any cause, or should they be stolen or tampered with by depraved urchins living over back of East Buffalo.

12 is a prune-wood handle for operating the wim-wam-wobbler. This handle is kiln dried in the oven of a cracker bakery until all of the juice is evaporated. It is then very carefully and tightly fitted into the wim-wam and thoroughly wetted with Croton water; this causes the handle to swell and makes a fit to beat the orchestra. From time to time during the day the trainman can throw water on the handle, and keep it in good condition always, as much depends upon the care of this handle.

13 is a supporting rib extending from the back portion of the frame, and carrying the wobbler gears for raising and lowering the coupler.

14 is the wonderful Gilderfluke reinforc-



GILDERFLUKE CAR COUPLER.

ing car frame. These frames are of cast iron, 47 feet long by 9 33-64 feet wide, and are stamped from flat castings 9 inches thick, on a new Gilderfluke automatic reciprocating punching press, at the rate of sixteen per minute, the press feeding itself and taking sheets from the bottom of the pile. The adjusting holes 26 are afterward drilled on a multiple drilling machine especially designed for the purpose, and will drill all of the holes at one time, and finish the operation in three-quarters of a minute by a dollar watch.

There are two of these frames on each car, about 3 feet apart. There has never been a car equipped with this frame that has been wrecked—they cannot be wrecked.

These frames weigh 17 tons each—34 tons in all—and as savers of good cars are well worth the price, $9.68, formerly $14.34. We have on hand 30,726 of these frames, slightly cracked and with a few blow-holes, but otherwise all right, which we will close out cheap to make room for the new spring style of frame.

15 and 16 are portions of a don'tulever bridge, made necessary by the slightly larger coupling. The bracket portion of this bridge is made of sheet zinc, painted blue and striped with yellow; the railing is made from 50 per cent. carbon steel tubing, 1¼ inches in diameter, and is nickel plated.

By removing the coupler and placing a section of barbed-wire fence across the end of the bridge, the freight car is at once transformed into an observation car, which can be attached to the rear of the "Northwest-by-South Limited," whenever the president desires an airing, or has a notion to inspect the right of way. This observation feature being so high in the air, offers another security in the fact that no cow can climb up and bite the president.

For this especial feature there has been conferred upon me the grand Imperial Zinc Cross of the "Coppery Order of The Boreal Kokobolas," by the Grand High Gilhooly of Wrangell Land.

This arrangement also serves to take the place of the common brand of red caboose of commerce. An antique oak revolving chair, having a cushion stuffed with hay, excelsior and sawdust is placed between the rails of the bridge. The conductor seated in this chair is enabled to overlook entire train, and to observe any fast mail train coming behind, in time to allow him to "make a sneak" and escape.

17 is a small compartment for holding chewing tobacco, loose and on the plug, cigars, tooth brush, whisk broom, extra signal flags, matches, hair oil and pepsin gum.

29 is a fixed focus Morris chair for the use of the trainman. This chair is sheltered from the rain, snow, hot sun and cinders by an aluminum roof painted dark red.

18 is a compartment under the fixed focus chair, and is intended for the reception of trainmen's belongings. There are divisions in this compartment for a tall silk hat, dress suit, a clean pair of overalls, collars, cuffs, red neckties and striped socks. Each trainman has as many of these compartments as he desires, and at the end of the run, transfers his goods to the returning train.

20 is a little tool box equipped by the company, and contains among other things saw, axe, screwdriver, pinch bars, crow bars, hydraulic jack, brad awl, glue pot, nails, screws, tacks, arnica, court plaster, witch hazel and corn plasters. Some of these articles will be found useful in the event of the earth being pulled out from under the train by "Wicked William of the Willemette."

21 is a copper fascia board.

22 is a common every weekday freight car body.

23 are bird's eye maple hand-holds covered with fish glue and shellac to prevent the trainman from slipping off the car and mussing up the nice clean ballast.

25 is a foot rest for the trainman while he is occupying the fixed focus chair, 29. This foot-rest has been termed by the canaille a "bunion rester." Maybe it is.

While this coupler is not just exactly economical in a direct way, indirectly it is a dividend winner from "way back." The use of this coupler tends to make the trainman a whole lot better. It will make him a good churchgoing citizen, and an honorable member of the community.

This will result in your road getting all the Sunday school picnics, and that your opportunity for dividends will arrive at the same time, because when you make them rates "you won't charge 'em a t'ing," p'raps.

I trust that no low-browed genius, whose ears project above the top of his head, will ridicule this wonderful invention in any manner whatever, as it would become necessary for me to drive him into the earth seven feet, and as I am very busy I can ill afford the time.

New Haven Shop Notes.

There are probably few railroad repair shops that have done more to determine the capacity of boring mills on work ordinarily done in the same class of shop on lathes than the New Haven shops of the New York, New Haven & Hartford. They have demonstrated, by the gage of dollars and cents, what the relative cost is between the two methods, for boring tires, boring and turning cylinder heads, boring and facing driving boxes, boring, turning and cutting off piston packing rings, and in fact all boring and facing work usually done in a lathe; the smaller work being handled on double-head Bullard borers.

The claim is not that the work is done better on the boring mills, but quicker, and therefore cheaper; and quicker not because of a man-killing drive, but simply because it is in the tool. The same principle is worked out in the blacksmith shop, where it has almost or quite reached the scientific stage, by cultivating the art of die-making for the bulldozer and Bradley hammers—a scheme we have championed to some purpose in the past, and one which, if made a special order, as in this shop, does not take long to get the balance on the right side of the books. One of the prettiest jobs we have ever seen from the bulldozer was a passenger truck swing hanger made here, of two pieces of 1 x 2½-inch material brought to a welding heat and having the jaw formed and body welded together in dies by one movement of the machine ram. It is not necessary to go into the details of this job for our blacksmith friends; they "know too well the story of their thraldom," when they build a swing hanger on the anvil. Master Mechanic Smith and his assistant, Mr. Leary, are very sensitive on the subjcet of shop expense, and lose no opportunity to keep it down by many good kinks and the aid of proper tools intelligently handled. Some of these kinks we shall show from time to time.

The Boston Blizzard.

The youngest junior philosopher took a trip towards Boston the other day, and the weather man got even for some past jokes by snowing him in at Sterling Junction, a little hole in the woods where he managed to crawl before the snow got in its finest work. Then he enjoyed a combination of New England winter, ulcerated tooth and the grip for two days, which wasn't so bad as it might have been, because he couldn't have got home anyhow. He kicked himself for not starting home the night before, but was afterwards consoled with the knowledge that the train he would have taken got snowed in at Norwich, and the passengers didn't get through, but had to sleep in the train. All the next day the trains were scarcer than hens' teeth, and although the snow plow of the Boston & Maine did get through from Nashua to Worcester, it didn't do much good, as the trains didn't follow, and the last one got stuck on "Break-neck Hill," near Worcester, and the five passengers enjoyed themselves sleeping in the smoker.

The great trouble with New England snows is that they are too deep in some places for the ordinary plows, and not deep enough for a rotary, at least not deep enough to warrant keeping them laying around for a possible use once in five or six years. If one plow could be employed and fitted with wings, so as to fly from one deep drift to the next, it could be used all over New England; but as it is, it might be needed for 20 feet in some cut, and then would be fanning air for the next 30 miles, except for the few inches of snow on the level. It's quite a question at best, but there seems to be room for improvement.

How to Lay Out a Locomotive Boiler.

BY HENRY J. RAPS.

The outline of the boiler is shown in Fig. 4, and one-half of the rear elevation of back-head in Fig. 2.

We will begin with the mud-ring, one-half of which is shown in Fig. 1. It is 2¼ inches thick, with a single row of rivets located 1¼ inches from bottom. The radius of outer corners is 2½ inches; that of the inner corners 1 inch.

The first rivet hole from corners in sides and ends are laid out so they will be located 1¾ inches from sides and ends, respectively, on the inside, as shown. The balance of rivet and plug holes are spaced 2¼ inches apart, as near as practicable; rivet holes to be 13-16 inch; plug holes, 25-32 inch.

Let us next lay out the back-head, a rear elevation of which is shown in the left half of Fig. 2 and a side elevation in Fig. 3.

Referring to Fig. 2, we see that the size of the sheet required for the head is 94 11-16 x 68¼ inches, and according to Fig. 3 it is to be ½-inch thick; also that the hight of head after flanging is 90⅞ inches; its extreme width is 60⅝ inches; width of lower part, 40½ inches; outer radius of flange, 3 inches, making the radius of the center of flange 2¾ inches.

We will begin by drawing the line for mud-ring rivet holes 1¼ inches from the edge and parallel with it.

At right angles with this line erect a line across the center of sheet from *A* to *B*. Twenty and a quarter inches from the line *A B*, and parallel with it, draw the line *E F*. From *A* to *D* on the line *A B* mark off a distance equal to the hight the sheet is to be after flanging, which is 90⅞ inches. With *C* as center, radius *C D*—which is 30 5-16 inches—describe the arc *D H*; at *C* draw the line *C I* at right angles with *A B*. Locate *I* 3⅝ inches from *C*. With *I* as center, radius *I H*, describe the arc *H G*; locate the point *J* 33 inches from bottom edge of sheet and 8 11-16 inches from the line *E F*. With *J* as center, radius *J F*, describe the arc *F G*, completing the preliminary line. As the line *E F G H D* represents the contour of one side of back-head after it is flanged, and is not necessary in laying out the head, but shown to give the beginner a better idea how the other lines are located.

As the outer radius of flange shown in Fig. 3 is 3 inches, it follows that the circular part of flange will begin 3 inches from the line *E F G H D*. Draw the line *K L M* equi-distant from *E F G H D*, using the same centers for describing the arcs. Mark off the circumference of the quadrant or circular part of flange; as the radius of center of flange is 2¾ inches, it follows that the circumference is 2¾ × 3.1416 ÷ 2 = 4 5-16 inches. Draw the line *N O P* 4 5-16 inches from *K L M*; then 2½ inches from the line *N O P* draw the line *a b B*, which represents the shear line or the edge of flange.

Opposite the point *J* add the amount represented by the dotted line, amounting to ¾ inch at the center of arc, as the sheet will stretch at this point in flanging, tending to narrow the flange. The lines *a b B*, *A a* form the outline of one-half of the sheet before flanging; the other half is its counterpart.

Locate the holes for mud-ring rivets, staybolts, fire-door, reinforcing plate, braces, water-glass cocks, gage cocks, circulating tube plugs, wash-out holes, etc. All holes which will not be distorted in flanging should be punched before flanging.

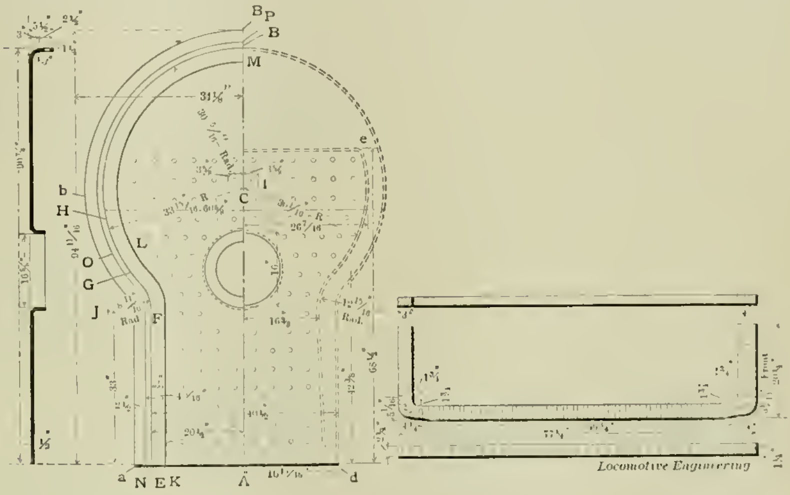


Fig. 3 Fig. 2 Fig. 1

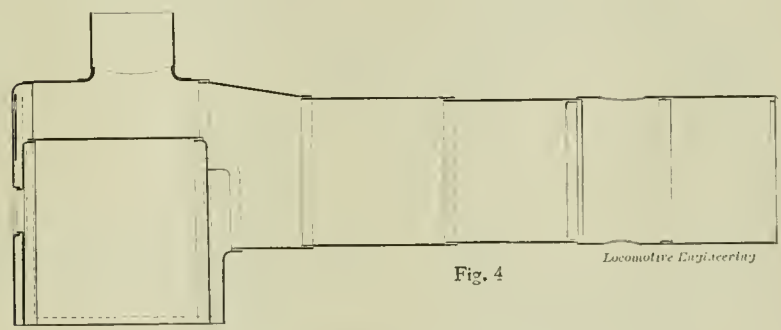


Fig. 4

LAYING OUT LOCOMOTIVE BOILERS.

The lower part of back sheet shown in the right half of Fig. 2 is tapered. The whole of the arc forming the upper part of the line *d e* is described with one radius from one center. The mud-ring rivet and staybolt holes, also door hole, should be laid out at the same time those in back-head are laid out, to avoid confusion.

Last of the Eddy "Clocks."

A recent visit to the Worcester roundhouse, of the Boston & Albany Railroad, revealed what is probably the last of the old Eddy "clocks," which were so famous twenty-five years ago, and which are still regarded affectionately by the older men. This is the old No. 39, which is now putting in her last work by raising steam for car heating at this terminal. Although covered with dirt from the fires and standing in expectation of being scrapped at any time, there is still something to be admired in this engine, and the work they have done will probably never be excelled by any engine of their weight—some say the heavier engines don't do it, but as one's memory is apt to play tricks, the first assertion is probably the safest.

We have received a circular from the Committee of Railroad Supply Men concerning the June conventions of this year. As our readers are no doubt aware, the conventions will be held at Saratoga, N. Y., beginning Wednesday, June 15th. The headquarters, as usual, will be in the Congress Hall Hotel. Those who intend to be present should lose no time in making application to Col. Clement for rooms. The prices are the same as heretofore. Very good arrangements have been made for the accommodation of exhibitors. Steam or power will be supplied to those who need it. Parties wishing for information about exhibits should apply to Mr. Hugh M. Wilson, *Railway Age*, Monadnock Block, Chicago, Ill.

From the *Pittsburgh Post*—which, by the way, has the most newsy railroad department of any daily paper of our acquaintance—we learn that the Pittsburgh, Bessemer & Lake Erie has already 150 miles of track laid with 100-pound rails. No other railroad has that length of track laid with such heavy steel. Estimating at the rate of 100 pounds to the yard for each side, 1,760 yards to the mile and 150 miles of track, we find that 52,800,000 pounds, or 26,400 tons (2,000 pounds to the ton), have been laid on the Bessemer since last May, not including side tracks, frogs, switches and bolts and straps. At $18 per ton this steel would be worth $475,200. From these figures it can readily be observed that it takes lots of money to build a road like the P., B. & L. E.

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The United States Metallic Packing Company, of Philadelphia, have taken out a new charter with the purpose of broadening their scope of manufacture. This company already make the Choteau pneumatic hammer, Dean pneumatic track sanders, pneumatic drills, Gollmar locomotive bell-ringers, and it is now the purpose of the company to still broaden the field of operations.

Baldwin Locomotive Works—Vauclain System of Compound Locomotives.

The Vauclain compound engines built by the Baldwin Locomotive Works have no receiver or intercepting valve such as are found in other systems of compound engines. A piston valve controls the steam distribution, which is effected by passing all the steam used directly from the high-pressure cylinder to the low-pressure cylinder, each side being a separate and distinct compound engine.

Fig. 1 is a section of the cylinder, steam chest and saddle, showing their relation to each other by location. Fig. 2 is a vertical section, drawn so to have the pistons all in the same plane, in order to better show their functions. A reference to Fig. 2 will make clear how the valve controls the admission and exhaust of each cylinder, the direction of the arrows showing how the exhaust from the high-pressure cylinders is the admission supply to the low-pressure cylinders, steam being admitted to both ends of the steam chest at the same time. The valve is practically perfectly balanced. The valve is reduced in diameter at the central part between the rings, and is also hollow, which construction leaves a cavity inside and out; the inner one of which is for low-pressure admission, and the outer one for exhaust from the same cylinder.

In compound operation, as shown in Fig. 2, the steam from the boiler is admitted to the steam chest, and passes through the wide open front port into the high-pressure cylinder. The back end of the high-pressure cylinder is at this time exhausting steam that had done work on the previous stroke, and is therefore exhausting through the back steam port and hollow valve into the front steam port of the low-pressure cylinder to be further expanded. While this is being done on the front side of the low-pressure piston, the rear end of the same cylinder is exhausting to the atmosphere the steam previously used.

When necessary to exert the maximum power of the engine at starting, steam is admitted to the low-pressure cylinders at the same time as to the high-pressure cylinders, and this is done by means of the starting valve which is shown in sectional detail in Fig. 3, and also in Fig. 4, which gives the method of piping to the cylinders. This valve, when opened, admits steam from one end of the high-pressure cylinder to the opposite end, being connected with the steam ports, and from there through the exhaust to the low-pressure cylinder. To trace the

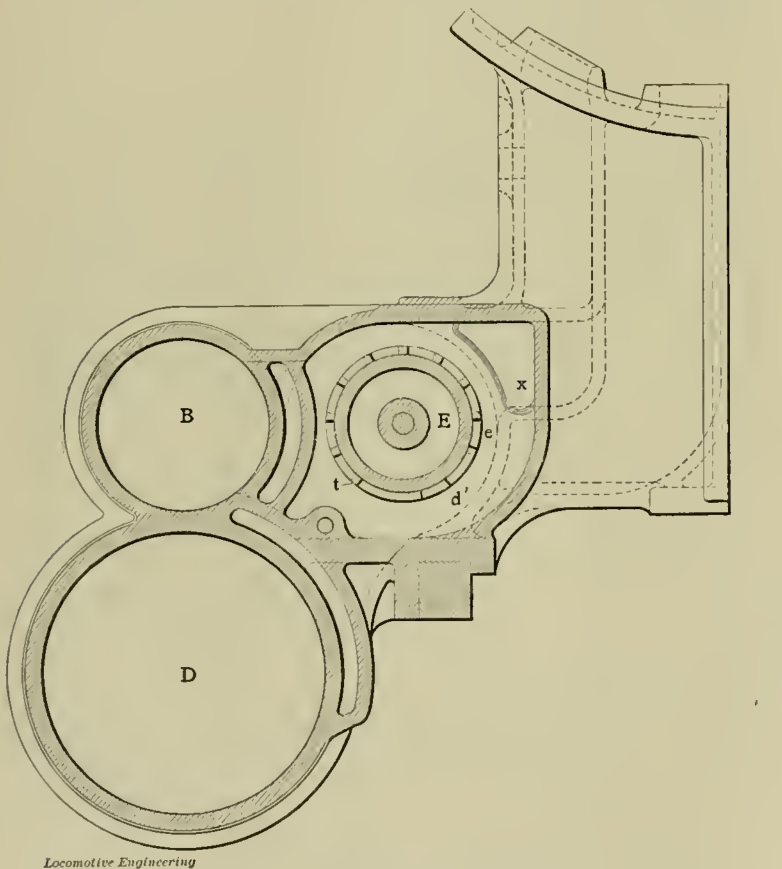


Fig. 1. SECTION OF CYLINDERS.

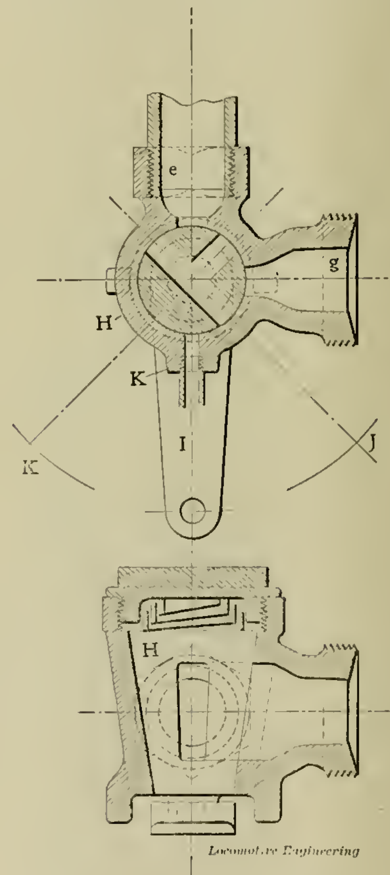


Fig. 3. STARTING VALVE.

action of the device, the steam may be followed from its entrance into the steam chest, thence through the pipe F connected to front steam ports of the high-pressure cylinder, down through the starting valve into the pipe G connecting the back steam ports of the high-pressure cylinder; from this point the steam flows through the exhaust cavity of the valve, directly to the front steam port of the low-pressure cylinder. The starting valve is operated from the cab by a lever, and acts as a cylinder cock for the high-pressure cylinder, being connected to the same lever that actuates the low-pressure cylinder cocks. When starting a train the valve is opened simultaneously with the cylinder cocks, which action admits steam to both the low and high-pressure cylinders; but the valve having three ports, live steam may be admitted to the low-pressure cylinder without opening its cylinder cocks. Valves to admit air, and also to allow relief from excessive pressure are shown in the high and low-pressure cylinders, respectively.

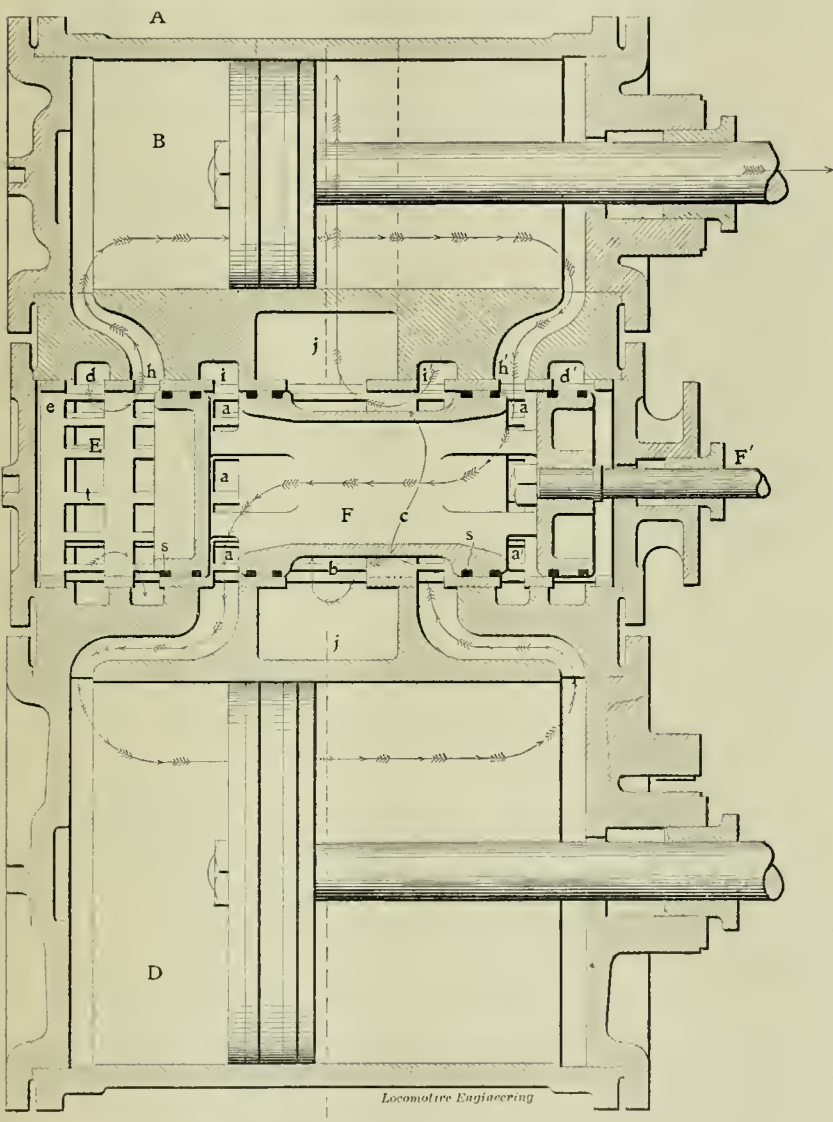


Fig. 2. VAUCLAIN COMPOUND—SECTION THROUGH CYLINDERS AND VALVE.

"Practical Shop Talks" is the title of a little book by Fred H. Colvin, one of our staff. It treats with methods of shop practice and management in an interesting and humorous manner, which is sure to find favor among all shopmen, as it points out its "object lessons" in a manner that is clear and convincing, as well as provoking many a smile by the lifelike characters and their remarks. We are sure no one will be disappointed in this little work, and it can be read with both pleasure and profit by any one who has an inkling of mechanics and who appreciates human nature. It can be had at this office for 50 cents a copy.

"The Economical Handling of Locomotives."

BY EUGENE MCAULIFFE.

Taking it for granted that the majority of engineers appreciate the responsibility attached to their position, and that they have sufficient latent honesty to make them desirous of returning the most perfect and economical service possible, in return for fair wages and considerate treatment, conditions they have a perfect right to expect, the writer, employed in handling a freight engine, submits the result of his personal observation and experience to his fellow enginemen, trusting that a few at least of the 80,000 engineers and firemen employed in the United States may find some suggestion that will help lessen the cost of operation of the locomotives handled by them.

A glance at the performance sheet issued from the office of the Superintendent of Machinery of any railway will show a wide variance between the cost of operating engines of the same class in like service. While it is a fact that some engines require more fuel and oil than others, the discrepancy is too wide and too marked to be attributed to this cause alone.

The primary duty of the engineer is that of handling his train intelligently and carefully, passing over the division with dispatch, while retaining the largest possible margin of safety. His next duty is that of handling the intricate and powerful machine in his charge in the most economical manner. True economy is most readily measured by that column of the monthly performance sheet that covers the total cost of operation, per car or train mile. An extraordinary valve oil mileage made at the expense of fuel and shop labor does not represent economy, any more than does the neglect of running repairs that tend to shorten the life of the engine.

To begin with, if possible, all necessary repairs should be made promptly, leaky flues, cracks in sheets, defective draft appliances, etc., waste coal directly. Valves and cylinder packing that blow, waste coal indirectly, besides reducing the tractive power of the engine. Flues should be bored out as often as necessary, and after running 30,000 or 35,000 miles, it usually pays to renew cylinder packing.

It is safe to say that the boiler of a locomotive is the foundation that the whole superstructure rests and depends on, and any steps taken towards prolonging the life of the boiler serves to lengthen the life of the whole locomotive proportionally. To keep down expensive repairs, and insure the reasonable life of a boiler, it is imperative that vigorous effort be made to keep the temperature of the fire box as nearly equable as possible. Every engineman has noticed that a locomotive boiler moves from ⅜ to ¾ of an inch on the frame while raising steam, moving back when the fire is removed and the boiler cools. The outer shell of a boiler derives the heat that serves to expand it from the supply contained in the water and steam which it holds. The effect of this heat is modified by the lower atmospheric temperature that surrounds the outer shell of the boiler. It is safe to say that this outer shell is not subjected to a temperature much higher than 300 degrees, while the fire box and back ends of flues are subject to a temperature of from 900 to 2700 degrees.

In view of the fact that the fire box is fastened to the shell by staybolts, flues and radial stays (when used), it is plain that any sudden lowering of the internal temperature, whether caused by the violent and copious admission of cold air through holes in the fire, a prolonged opening of the fire box door, or the lowering of the steam pressure by forcing into the boiler large quantities of feed water at a temperature of from 150 to 200 degrees, will cause distortion of proportions, what cannot help but damage flues, sheets and staybolts.

With boilers of a shell diameter of 52 inches and upwards, the one item of renewing broken staybolts constitutes a large part of the expense of repairs. The cost of replacing a broken staybolt sometimes reaches $1.00, making no allowance for loss occasioned by taking engine out of service. The sudden changes of temperature before mentioned by racking the boiler and bending the staybolts, ultimately breaks them. From tests made we learn that average staybolt material will stand several thousand bendings, but the process, if kept up, will eventually break even those made from the most carefully selected iron The fire box will often stand months of abuse, but under rough handling the weakening process goes steadily on until an unusually severe trip develops a sufficient number of broken bolts to necessitate the holding in of the engine for repairs at an expense to the owners and crew alike.

With all the effort that conscientious enginemen can make in the way of nursing the boilers in their charge, the cinder-pit force can undo everything while cleaning the fire preparatory to housing at the end of the trip.

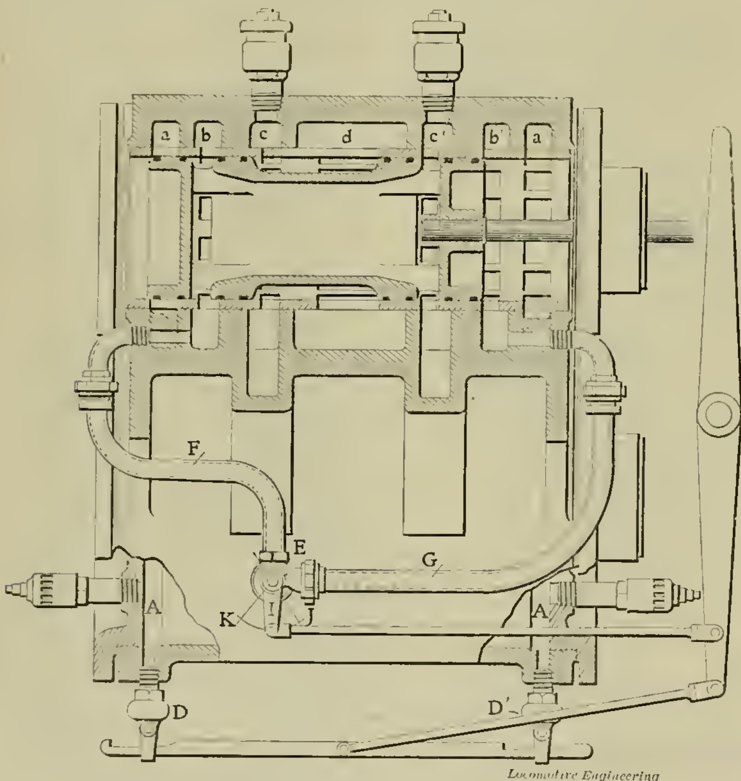


Fig. 4. VAUCLAIN COMPOUND—APPLICATION OF STARTING VALVE.

The reckless roar of the blower carrying thousands of cubic feet of cold air through a fire box, from which the fire has been removed, has chilled the blood of many careful enginemen, as well as ruined numerous fire boxes that should have lasted for months. It is not uncommon to see the blower left on full for an indefinite period, fire door and dampers wide open, while the man in charge waits for word from his assistant in the pit to commence operations. Roundhouse men invariably get their start in the cinder pit; they come to the business willingly, but uninformed; no one takes the trouble to instruct them and they go on for months and years helping to destroy dividends. The first thing that should be impressed on the mind of every man who has any connection with this important part of a locomotive is covered in these few words: "Use the blower in self defense only, and then as gently as possible." Dampers should always be closed before an engine leaves pit to move in the house, and, under no circumstances, should the injector be used after the fire is removed.

There has been a great deal said and written on the subject of combustion, but it is safe to assume that only a small per cent. of enginemen understand the ethics of this question, neither do they care to go deeply into it.

Any man of average intelligence can, however, soon learn by observation that coal requires a plentiful supply of air properly delivered to effect its combustion; an excessive quantity, however, carried through or over a fire is a grievous detriment to both coal pile and boiler. In a few words, give your fire all the air that can pass through the openings in grates, do not obstruct its passage by clinkering or banking, fire lightly and often, always endeavoring to keep the bed of fire as thin as possible. To this end some preparation is necessary before pulling out, or the severe exhaust occasioned by working the engine toward full stroke will tear the fire full of holes, admitting a whirlwind of cold air that cools the fire box and flues, working untold harm.

Man and Engine Out of Proportion.

"Men who run locomotives in the outskirts of civilization meet with curious experiences," remarked the engineer of the Plug. "One day I was running an engine on the construction of a railroad that went into a region similar to that shown on the front cover of the January number of LOCOMOTIVE ENGINEERING. There were few human settlers to be found, and those who were met were the greenest citizens that ever gaped on looking at a locomotive.

"One day I had got to the extreme point of track laying and had been switching some cars, when I noticed a particularly gaunt-looking native looking on with extreme interest. When I stopped and began oiling round he followed my movements very closely, and when I returned to the cab he kept watching me very intently.

"'Is there anything I can do for you, my man?' I inquired, thinking that he wanted to know something. 'No, boss,' he replied; 'I war jest wonderin' how a big engine like that lets herself be driven by a small rat of a man like you.'"

Mr. Geo. D. Greer has been appointed traveling engineer of the Louisville, Henderson & St. Louis. The official headquarters of this road are at Louisville, Ky.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Improved Valves for Water-Raising System.

Readers who have familiarized themselves with the development of the water-raising system on Pullman sleeping cars, as investigated by the Air-Brake Association, and presented on page 478, June, 1896, number of LOCOMOTIVE ENGINEERING, will have learned how this system sometimes interferes with a proper operation of air brakes on passenger trains. The Westinghouse Air-Brake Company, while not interested in this system, seeks to lessen its interference with the air brakes by providing suitable valves for its better operation. With this object in view, this company has prepared the valves illustrated and described herewith.

To attach the reducing valve, Fig. 1, connect fitting 30 with a nipple to air tank and pipe to water reservoirs from *Z*, inserting two cocks in this pipe. Attach levers to the cock handles and extend same to opposite sides of car. Close one cock before recharging water tanks. The valve is adjusted to deliver 20 pounds pressure on the water for forcing it throughout the car. Necessary readjustments are made with nut 27.

Pressure entering valve, Fig. 1, at *Y* passes to chamber *a*, thence past valve 18 to chamber *b*, and by passage *c* to *Z* and

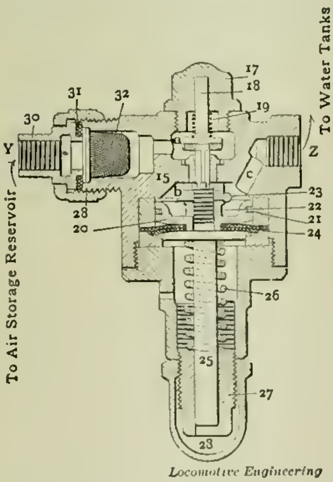


Fig. 1. IMPROVED REDUCING VALVE.

the water reservoirs. As the pressure in the latter approximates 20 pounds, piston 20 is forced down and spring 19 closes valve 18. As the air pressure in the water tanks diminishes from the use of water, the pressure on piston 20 is likewise affected, and, rising, opens valve 18 and restores the air pressure.

Attach the governor, Fig. 2, to air tank with a nipple at *X*, and from fitting 46 *(W)* extend pipe to auxiliary reservoir. The pressure on spring 42 is such that a pressure in chamber *e* of 60 pounds on diaphragm 40 is required to raise its valve from its seat. Therefore the auxiliary reservoir of the air brake is charged to this extent for braking the train before any pressure passes to the air tank of the water-supply system.

Air pressure from the auxiliary reservoir entering the valve at *W* reaches chamber *e* through port *d*, and as it approximates 60 pounds, diaphragm 40 and its valve are lifted, and valve 38 is forced from its seat thereby, permitting the pressure to pass to chamber *f*, and through port *g* to the air tank of the water-supply system. The stem *h* of valve 38 is purposely made a comparatively snug fit in its aperture in order to produce a sluggish feed of air past it to the air tank, causing auxiliary reservoir pressure to be only slightly affected by any demand upon its air supply.

Fig. 3 shows how these valves are usually arranged in combination with the air-brake system and the air and water reservoirs of a passenger equipment car.

Specifications for Air-Brake Hose.

Rigorous qualifications for air-brake hose have never been required by railway companies in general, and consequently none were ever framed until the Peerless Rubber Company suggested a list which they submit in a pamphlet to those interested. The qualifications as drafted contain much merit, and would certainly better the air brake service if adopted. They are as follows:

"Each standard length of air and signal hose must be branded with the name of the manufacturer, and the year and month in which made, name of road, and a table of raised letters denoting the years and months.

"All cotton duck to be used in air brake and signal hose to weigh not less than from 20 oz. to 22 oz. per yard, 38 to 40 inches wide, to be loosely woven and long fibre. Duck must be frictioned on both sides, and in addition to the friction must have a heavy coating of gum on one side, so when made up there will be a distinct layer of gum between each ply of duck. Hose without the coating will be rejected.

"All air brake and signal hose must be soft and pliable, and not less than four-ply. The tube to be hand-made and so firmly joined to the canvas that it cannot be pulled away without breaking or splitting the tube. The tube, friction, coating and cover to be of the same quality of gum.

"The tube to be not less than 3-32 inches thick. The inside distance of freight hose must not be more than 1 5-16 inches nor less than 1¼ inches. Outside diameter not more than 2 inches nor less than 1⅞ inches. The inside diameter of passenger and signal hose must not be more than 1 1-16 inches nor less than 1 inch. Outside diameter must not be more than 1¾ inches nor less than 1 11-16 inches. Diameter to be as specified throughout the entire length. All short lengths to have capped ends. All caps must be vulcanized on, not pasted nor cemented on.

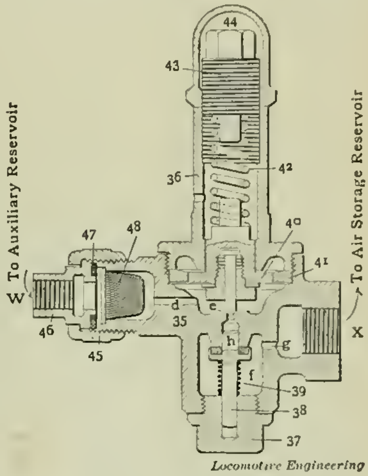


Fig. 2. IMPROVED WATER-PRESSURE GOVERNOR VALVE.

"The friction will be determined by the force required to unwind a section of hose 1 inch in length. The force being applied at the point of separation. With a force of 25 pounds the separation must be uniform and regular, and when unwound from outside to tube the average speed must not be greater than 12 inches in 20 minutes.

"The 1-inch section of the tube or inner lining should then be taken from the piece of 1-inch section used in the friction test, and cut at the thickest part of lap; then marks 2 inches apart will be placed on it and stretched 10 inches from the aforesaid 2-inch marks, and released immediately. It will then be re-marked, and will be stretched 10 inches or 400 per cent. without breaking, to remain stretched 10 minutes, and to be measured 10 minutes after the strain is removed. In no case must the piece show more than ¼ inch permanent set or elongation in 2 inches. Hose should be at least from three to seven days old before testing.

"All rejected material may be returned, the shipper paying freight both ways."

CORRESPONDENCE.

The "Kicker" Kicks.

Editors:

I was walking through the A. B. & C. roundhouse recently, and, seeing the "Kicker's" engine standing over a pit, went over to it to see if he was around. As I rounded the pilot I saw him working on his air pump.

"Hello, there!" he cried, in his characteristic way; "come here, you're just the fellow I want to see. That dog-goned cuss has packed this pump with asbestos. You know it was runnin' hot when I saw you? Well, he put in new packin' rings again, an' the Old Man made him try to fit 'em; but say, he couldn't fit 'em any better'n a wood-butcher could do blacksmith work. An' then he didn't do a thing but go and pack it with this durned asbestos, 'cause every other kind of rod packin' would burn out, I guess, an' now see how this rod is cut. Say! you'd a thought it was a Fourth of July fireworks to seen that pump throw sparks last night. Looked like Roman candles, sky-rockets and spittin' devils. I've been tellin' 'em that when a pump is hot enough to burn the packin' out it ought to burn it all out, but this durned stuff bakes harder'n a rock. He tells me that he soaks it in oil and plumbago. Humph! I'd like to see him find the oil and plumbago in it now."

"Why can't he fit the rings?" I asked.

"First place he don't know how, an' then he says the cylinder is 'way out of true. That's another sample of cheapness. It's cheaper, so they think, to have that fellow work two or three hours every other day on this pump, and pay him at least 25 cents an hour, than it would be to bore that cylinder out and be done with it. Say, his time on this pump alone would pay for a new cylinder in less than a month. An' then the transportation department always tacks ten or twelve cars on number three an' the dispatcher wants to know 'why we can't get away,' when the brakes won't release. Why, the extra coal I burn every trip gettin' away from stations and makin' up the time I lose releasin' brakes would pay ten times over for borin' out the cylinder."

As we got up into the cab I saw that he had his brake valve apart also. The feed valve piston was lying on the seat box. I picked it up to look at it, whereupon he broke out again.

"I've been layin' for that feller all mornin', but he hasn't been 'round this way. That's another sample of stoppin' a leak with a bung hole open. Look at those gaskets (diaphragms). Can't afford to buy 'em from West'n'house at a few cents a piece and get good ones, but they pay him 25 cents an hour to cut em out of common sheet gum, and' they only last a trip when the pump is runnin' hot. The ones that came in that valve lasted six months, an' the pump run hot most of the time, an' I guess they'd been all right yet if that chuckle-headed fool had let 'em alone; but he got it into his head that they ought to be played out if they wasn't, and so he took 'em out. He lost 'em an' now we have to put new ones in every trip. That cheap gum ain't good for much, anyhow. That rotary leaks a little, but I'm afraid to report it for fear he will make it worse. He won't try to face one in a lathe, always grinds 'em in with em'ry."

"What's the matter with facin' 'em?" I asked.

"O, he says the lathe ain't no good. Don't know as I blame him much, either. The lathe they gave him has been in the back shop ever since we had a shop. Took it out an' put it down here, an' put a new one in up there to turn bolts in. Tell you the bosses don't know how particular air-brake work is. Seem to think the air brake is a sort of side issue that they have to put up with, but they make rules 'bout how we must take care of it and handle it. We test brakes five times in a 150-mile division, an' only one hill, an' never cut the train at all. But that's the rule! As far as all the good it does is concerned, we might just as well not do it. I'll bet nine out o' ten o' them inspectors wouldn't know a defective brake if it hit 'em over the head with a brake beam. Might think it worked kind o' curious, but if one shoe touched the wheel it would be all right. Why, say, one feller was inspectin' the brakes one night and heard the air comin' out of the exhaust of the triple, and looked at the port an' seen it was tapped out, so he thought they left somethin' out and' he plugged it up. We found it at the next stop all right an' they investigated, and this feller's foreman tried to make out that he did just right. Talk about instruction. The bosses need some, too. Tried to get the Old Man to put a big main drum on this engine, an' what do you s'pose he said?"

"Can't imagine," I replied.

"This is what he said, 'That's all right, John, but you forgot that the bigger the drum is the more air the pump would have to pump to fill it. Now don't you see the small drum is the easiest on the pump?' Say, that corked me."

Just at this point the Old Man came up

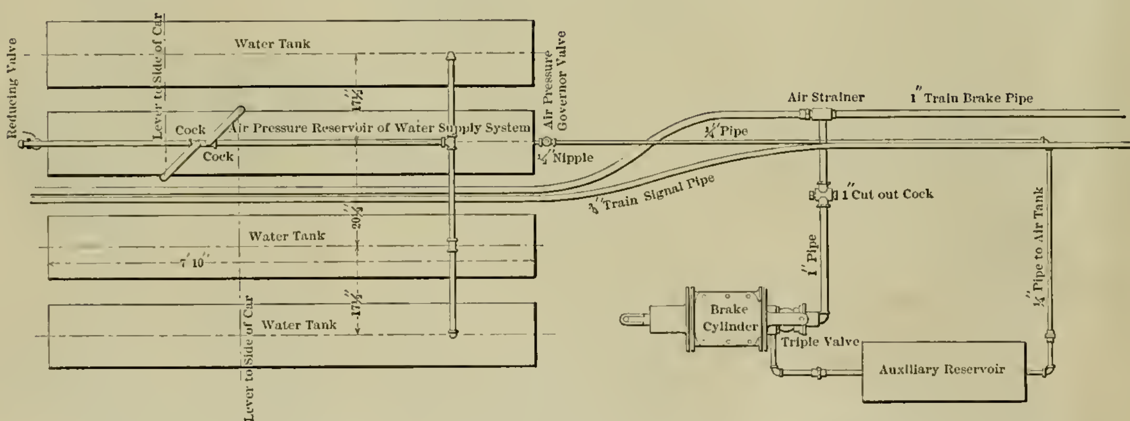


Fig. 3. ARRANGEMENT OF TANKS AND AIR VALVES FOR WATER DISTRIBUTION SYSTEM OF PULLMAN SLEEPING CARS.

himself, and John introduced me to him. I was invited to call on him at his office that afternoon, and with a promise to do so I left.

BOB MICHAELS.

Atlanta, Ga.

Good Points About the Semaphore Gage.

Editors:

In February LOCOMOTIVE ENGINEERING, a description is given, accompanied by illustrations, setting forth some of the prominent features and improvements which the new semaphore air gage recently patented by Messrs. Nellis & Hutchins possesses over the pressure recorders in common use, and calling the attention of the reader to the position of the hands on the dial and the arrangement and spacing of the numerals. The hands being at right angles to each other when indicating 70 and 90 pounds, and a variation of 5 pounds in pressure requiring a movement of the pointer of about 1 inch.

It can be seen at a glance that this gage fills a want that has been felt ever since air brakes were first used, and its use is destined to improve the air-brake service all over the country.

This improvement of the service must result in a big saving in dollars to railway companies and greater comfort to the traveling public.

In the April, 1896, LOCOMOTIVE ENGINEERING I suggested that the air gage be brought down to the engineer's valve, so that when applying brakes, the engineer could tell just exactly how much air he was exhausting, and thus be enabled to make better and smoother stops; but with the "semaphore" a position so close will not be necessary, as the long sweep of the indicator in light reductions can be easily seen, and when the limit of 20 pounds, full service application, is reached, the hands are in a horizontal position; so that if this gage is only placed within a reasonable distance from the brake valve, and in line of the engineer's view, no trouble will ever be experienced in reading it.

I was particularly impressed, while recently using a "semaphore" gage, by the ease with which a slight leak in the train line could be detected, and, in fact, leaks of any and all kinds. This feature seemed to commend it as strongly to me as any other which it possesses.

Everybody knows that if the small leaks can be kept out of the brake mechanism, good results will invariably follow, and little or no trouble be had in using it; but heretofore slight leaks were scarcely perceptible on the gage, and therefore passed unnoticed. With the new gage this is different. A slight leak is almost as readily perceived as a 5-pound reduction is on the gages now in general use.

In the matter of initial reduction much shock and damage to lading will be avoided on long freight trains, because the engineers can make a reduction of 5 pounds, the amount necessary to force the pistons beyond the leakage grooves and bring the shoes up against the wheels —and have it exactly 5 if he chooses—then he can reduce pound by pound until the brakes are full on, and each reduction can be easily seen on the gage.

I feel confident that a marked improvement in air braking will be had wherever the "semaphore" is used, and also a much pleasanter life to all who ride in our passenger coaches or freight cabooses.

J. P. KELLY,
New England Ry.

Sandy Hook, Conn.

What Was the Trouble?

Editors:

Our engine No. 85 was recently equipped with a new '92 model brake valve. After applying brakes in the emergency, we could, with a main reservoir pressure of 95 pounds and train line pressure 0, put the handle either in release or running position, and black pointer would go up to 60 pounds. Then in about two minutes the train line pointer would drop back to 20, and stop; but the brake would not set in the meantime, although it could set all right with either a service or emergency application ordinarily. Found the trouble. Will someone please tell me what was the matter?

ERLE MILHONE,
K. C., Ft. S. & M. R. R.

Kansas City, Mo.

[Mr. Milhone sends us the answer to his problem, and requests that we withhold it from publication for one month, so as to give readers a chance to work it out. As a hint to a solution, we would say to look all around. Things are not always what they seem.—Ed.]

MICHIGAN CENTRAL AIR-BRAKE INSTRUCTION CAR.

To Get Dry and Clean Air.

Editors:

After reading the article on main reservoirs and air freezing by Mr. A. L. Beardsley, in last number of LOCOMOTIVE ENGINEERING, I thought he might be helped out if the air were pumped in dry and warm. I have a scheme which I successfully used for some time past. It consists of a box, 6 x 8 inches, with ten or twelve ½-inch holes, placed in the corner of the cab, to which the suction of the air pump is attached. In this box is a sponge which catches the dirt and dust. Every few days the sponge should be removed and washed. It is surprising to see the amount of sediment it catches.

F. B. F.,
Engineer, D., L. & W. Ry.

Washington, N. J.

Air-Brake Men's Fifth Annual Convention, Baltimore, April 12th.

The Michigan Central Air-Brake Instruction Car.

Editors:

The Michigan Central air-brake instruction car, which has now been in service over a year, was remodeled from the dining car "Niagara Falls," in their shops at Detroit, Mich., under the supervision of Mr. E. D. Bronner, assistant superintendent of motive power.

The car is mounted upon two six-wheeled trucks, is 55 feet long inside, and weighs 63,000 pounds. It is exceedingly well lighted by thirty-six windows. It is divided into two compartments, one for an office and sleeping room, and the other for the instruction room, which is 45 feet long.

Entering the instruction room from the end of the car, in the corner at the right is a 9½-inch Westinghouse air pump, which supplies air for the equipment in the car. Steam for running the pump is supplied from a locomotive coupled to the car, and at several points on the system air is obtained from yard or shop plants, thereby avoiding the necessity of running the pump. Below the pump is the main reservoir, which is 23 x 41 inches. Standing at the end of the main reservoir, at a convenient hight for observation, is a sectional 8-inch pump, to which is attached a sectional E-8 pump governor, the pump being arranged to turn on a pivot. Next to this is a push-down cam driver brake and a sectional plain triple working tandem with driver brake triple. Next is a rack to which is fastened the '90 and '92 brake valves for operating the brakes in the car, and between them is a sectional '92 brake valve, slightly elevated. The duplex gages, showing main reservoir and train line pressures, are fastened to the wall above each valve.

AN INTERIOR VIEW OF THE MICHIGAN CENTRAL AIR-BRAKE INSTRUCTION CAR.

Fastened to the opposite side of the car are numerous sectional parts, consisting of quick-acting triple, auxiliary reservoir and brake cylinder for freight car, conductor's valves, retaining valve, whistle valves, injectors, etc., and at the end of the car, opposite the main reservoir, is a convenient writing desk, where each man registers his name on entering the car. This gives an actual floor space at this end of the car of 7 x 20 feet for the accommodation of a large class.

Next to the rack supporting the brake valves, and standing on the floor, is a representation of a passenger car with 10-inch brake cylinder and levers, rods and brake beams, all working. This occupies but a small space, and can be more readily understood than if fastened to side of car. This passenger brake equipment has 60 feet of piping for both brake and signal. Above the passenger brake are sectional Nathan and Detroit air-pump and cylinder lubricators.

On the opposite side of the car are twelve sets of freight brakes, arranged horizontally in three tiers of four sets each. These also have the full complement of piping, angle cocks, cut-out cocks, etc.; all in plain view. There is a large floor space between the passenger brake and freight brakes; also between each tier of freight brakes.

Located on a board, at the end of the freight brakes, is a gage showing train line pressure, and two duplex gages showing auxiliary reservoir and brake cylinder pressure in the first and last brakes, which have been arranged for long and short travels. The driver and passenger brakes also have duplex gages. Every other brake has a gage on the cylinder.

The interior woodwork is maple and

walnut, and retains the same decorations it had when used for a dining car. The ironwork is painted brown.

Entering the office from the instruction room, the water cooler, washstand, etc., are seen. A partition divides these from the Baker heater which heats the car, and next to the heater is the linen closet and wardrobe. At the left is a table, four leather upholstered seats, a writing desk and bookcase. Above the table is a sleeping berth of the standard pattern.

The car stops at all points where men lay over, and where men are employed who handle or care for the brakes. These men are admitted in regular classes, after which they are examined and their standing recorded.

W. W. White,
Air Brake Inst., Mich. Cent. R. R.
Detroit, Mich.

A patent for a hose coupling head in which is an angle cock opened and closed when hose is coupled and uncoupled, similar to the one illustrated in these columns last month, has been granted to a Pittsburg man.

Ice in the Air-Brake System.

Editors:

It is almost impossible to attach sufficient importance to the draining of reservoirs and triples in winter. As dirt is the greatest enemy of the air brake in summer, so, I believe, water is the greatest enemy in winter.

I was once on an engine equipped with a driver and tender brake, and although piston travel was correct, brakes would not hold but little, and then only by a continuous application. Part of the time brakes would not apply at all; as Danny Dugan would say, "De pig wouldn't try to eat de cabbage." As it was winter, I concluded that water was the trouble, and immediately on getting the engine in the roundhouse, I took the plug out of drain cup under the tender, also took bottom plug out of both driver and tender triples, and it was little wonder "de pig wouldn't eat." Ice is what a torch showed in the interior of "de pins." A thorough thawing out and perfect draining, and lo! the best set of brakes I ever saw. I believe a drain cock in plug of triples would be an improvement, as they would stand better show of getting drained. Of all things aggravating and useless, is a driver or tender brake that don't want to set at all, and after dint of coaxing will set, but quickly leaks off through cylinder packing or otherwise.

In connection with the brake trouble first mentioned were the following symptoms, that are not yet clear to me, and I would like some enlightenment on same. In making any application of brakes, as soon as graduating piston seated, and exhaust from train pipe therefore ceased, piston would almost immediately rise again, and a discharge of air of perhaps two seconds duration would follow, and we would immediately hear both tender and driver triples whistle off. This was evidently an increase of train pipe pressure. But where did it come from? This would occur either with or without train. Thawing and draining cured everything, which proves there was nothing wrong with the brake valve.

L. D. Shaffner.
Missoula, Mont.

[Ice was undoubtedly the cause of the trouble, as thawing out allowed the brake to work with its accustomed efficiency. Perhaps the triples had a film of ice be-

ANOTHER INTERIOR VIEW OF THE MICHIGAN CENTRAL AIR-BRAKE INSTRUCTION CAR.

tween the slide valve and seat, which, for a time, blocked the passage to the brake cylinder, and some at the auxiliary pressure passed around packing ring in triple piston to train pipe, thence out through the brake valve by raising the equalizing piston. Possibly then the film closing the graduating port broke, and auxiliary pressure quickly rushed into the brake cylinder, reducing the auxiliary pressure considerably below train pipe; the triple being still held by the film in application position, until such time that it jerked loose and went clear to release position, similar to a triple with much friction, as described in last column on page 99, February number.—Ed.]

Plumbago on Brake Valve Gaskets.

Editors:

I wish to say to the repair men who have the '92 brake valve to dissect, that they will have less trouble from the valve body sticking to the gasket if they will put a small mixture of graphite and air-brake oil on the gasket. This will make it lift off easy.

F. A. Mitchell,
Southern Pacific Ry.

Stockton, Cal.

Ten Hints for Air-Brake Instructors.

1. Don't crowd a man with questions when he is "rattled."

2. Don't keep up a too steady fire of questions on a bashful man.

3. Pull along the toiler, even though it be at the expense of neglecting his more brilliant brother.

4. Encourage a man by occasionally giving him a question you know he can answer, and thereby save him from a possible fall by the wayside.

5. Bump the ground with a would-be wit.

6. Prevent imposition from prompting and other illegitimate means by following up the original question with "Why?" when in doubt.

7. Don't have a man pass an examination, but make him understand every portion of the ground gone over.

8. Don't strive to achieve the reputation of being the hardest examiner. This reputation properly belongs to the novice instructor. Rather seek to have men say they learned more from you than anyone else.

9. Remember that while you know a good deal about air brakes, there may be something you don't know; and don't forget, when tempted to lose patience with a dull man, that there was a time when you didn't know as much about the art as you know now.

10. Study the character of each man in your class, ministering to his needs in a proper manner, and you will be a popular and successful instructor.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(24) J. H. B., Newark, N. J., asks:

1. Are triples made purposely so they will cause that whistling noise in releasing? A.—1. No. 2. How is the noise caused? Of course, I know it is caused by air escaping from the brake cylinder; but how or why does it whistle? A.—2. Because of the high-pressure air rushing swiftly out through the small port.

(25) J. H. B., Newark, N. J., writes:

If in tests made to see how much air goes from train line to brake cylinder in emergenry a 14-inch cylinder had been used, what would have been the result? A.—A less train line pressure would have gone to cylinder in proportion to pressure sent from auxiliary, because ratio of volume of train pipe to auxiliary is less. Final brake cylinder pressure would be less.

(26) E. G. R., Mt. Savage, Md., asks:

What is the best way to remove hardened Vulcabeston packing from stuffing boxes of air pumps? It often gets so hard that it will not blow out, and it is many times necessary to remove piston and rod and drive it out with a bar, more especially the air cylinder gland. Is there no way to soften this substance? A.—We know of no way except to coax it out by means devised by the operator's ingenuity. If any of our readers can help us out on this matter, we would be pleased to hear from them. We do not know how asbestos can be softened after it once becomes baked hard in the stuffing box.

(27) F. L., Pleasant Valley, N. J., asks:

In a recent answer you stated that much of the trouble with signal not acting properly was due to discharge valves. Will you kindly specify how discharge valves may be responsible for such troubles? A.—The earlier form of car discharge valve had in it a thimble-shaped strainer, similar to that in the quick-action triple, which became clogged with sand and spark cinders, and a sudden discharge could not be made. The slow discharge thus occasioned was similar to a leak, and would be supplied by the reducing valve without blowing the whistle when the cord was pulled.

(28) J. H. B., Newark, N. J., writes:

It was claimed that quick-action triples could not be used on tenders, but you say they are now used. What prevented their being used before? Could they not be used on engines if desired. If not, please why not? A.—Quick-action triples are not generally used on tenders because the trouble had from quick action, nearly every time brake is applied on light engine moving about ash pits, coal chutes, water cranes and turn-tables, would overbalance the good accomplished in train service. With the high-speed brake, however, where every available bit of brake power is utilized, quick-action triples are used on tenders, regardless of the troubles on turn-tables, etc., above mentioned.

(29) F. L., Pleasant Valley, N. J., asks:

1. What is the use of circumferential groove in the signal valve? A.—1. From top of groove to top of bush the whistle stem is a snug fit, but allows air to slowly feed by. From the groove down is not a fit. When the stem rises, therefore, the groove really becomes a port opening. 2. What is the lift of diaphragm and valve, in signal valve, with the ordinary reductions. A.—2. Such that the circumferential groove is a little above the top of bush. The lift varies in different valves from 1-32 inch to 3-32 inch ordinarily, and in some cases until the diaphragm valve strikes under side of cap, being controlled by reduction in signal pipe and fit of stem.

(30) F. L., Pleasant Valley, N. J., writes:

What takes place when in pulling cord too long, making a heavy reduction, whistle blows twice; that is, how does its heavy reduction affect the diaphragm in a way to cause it to lift twice? A.—Before cord is pulled, pressures above and under diaphragm are equal. When cord is pulled, however, and pressure above diaphragm is reduced, pressure under diaphragm, being greater, lifts and discharges quickly, having less volume and larger exit opening, until under pressure is equal again with above pressure. If the reduction above diaphragm is continuous, the diaphragm will rise, discharge under pressure quickly, then seat. As the reduction above continues, and is similar to second reduction, the diaphragm will lift and whistle will blow again.

(31) F. L., Pleasant Valley, N. J., writes:

When train line of signal is leaky, what effect does the leak have when cord is pulled? Would this leak have a tendency to prevent second pull giving a blast on account of pipe not being recharged fully, even allowing proper time between, on account of leak taking away part of the air intended for recharging? A.—The leakage produces little effect, as the pressure-reducing valve, which is ordinarily closed after the system is charged, is open, supplying the leak. The system is thereby kept charged, for the feeding capacity of the reducing valve is much greater than an ordinary leak in the system. If the leakage were considerable, however, the tendency would be for the whistle to blow when the pressure was discharged at the car valve, and would interfere with the second blast's reliability.

(32) J. H. B., Newark, N. J., writes:

In question 90, July, 1897, that a quick down movement of piston in engineer's valve may cause a surge that would release brakes on train, cannot understand how a simple down move of this small piston, not to exceed ¼ of an inch, could cause a surge that would be noticeable. Would you please explain? A.—It is not the simple downward movement of equalizing piston that causes a surge that releases brakes. It is the closing of the piston which abruptly stops the forward flow of pressure coming from the rear of the train pipe to get out at the front end. This current of air, finding its exit cut off suddenly, will recoil and cause a greater pressure momentarily in the forward end of pipe than if allowed to get out. A properly working equalizing piston never should, and never does seat until after all current has ceased, and pressure is the same on front and rear ends of train pipe.

(33) F. G. S., Chambersburg, Pa., writes:

1. What oil is best to use with Trojan grinding compound, and is same oil "O. K." to get finishing polish on quick action triple valve seats and slide valves? A.—1. Sperm oil should be used, and is "O. K." to obtain the required finish. 2. Advise which grade of Trojan grinding compound is the better to use on slide-valve seats? A.—2. The extra fine grade of Trojan grinding compound is the best and only grade to use to finish the slide valve seat, the medium grade may be used if much grinding is necessary. 3. Is there in the market a compound or mixture made from float emery for brass and cast iron bearings such as valve and seat of '92 brake valve? A.—3. Trojan grinding compound is excellent for the rotary valve in the D5 or F6 brake valve, using it carefully and finishing with the extra fine grade. Float emery, however, may be obtained from almost any supply house.

(34) F. L., Pleasant Valley, N. J., writes:

During the late cold spell all our men had trouble with their signal valves. Whistle would at any hard shock blow a long blast. If cord was pulled, the blast would last many seconds. By tying waste around bottom of signal valve and burning it, trouble would be stopped for several stations, then start again, and continue till thawed out again. Its lifting with a jar, as it did in some cases, would seem to prove it too sensitive; while its staying up so long when cord was pulled, as it did on all engines unless kept thawed, would seem to show lack of sensitiveness, else it should have seated soon. Please say what effect the cold has on it to cause it to act in this way. A.—The snugly fitting part of the stem probably froze to the bush. This would cause the troubles above enumerated. Possibly the trouble was aggravated by too snugly fitting stem. Too snugly fitting stem causes long blast. Short distance between top of circumferential groove and top of bush causes whistle to be too sensitive.

(35) J. H. B., Newark, N. J., writes:

In coupling train after parting I always apply lightly on head section before cock is opened between two sections, and find that I get brakes off quicker than if I don't do so. Have talked to many of my brother engineers, and all agree with me; yet it is said that this practice is wrong, and no reduction should be made. Will you please state the difference in effect on brakes of two methods, and which is correct from your standpoint? A.—In making the light application on the head section, you draw air from your train pipe at your brake valve, where it escapes into the atmosphere and does no work. If, instead, this air were not thus thrown away, but was allowed to remain in forward section train pipe until the two sections were coupled up, and then sent back to do work by helping to charge up train pipe of second section, it would be much better. Increasing the train pipe pressure is what releases brakes, and it has been practically proved by many engineers who are prominent air-brake men, that the latter method is certainly the right one. The question is merely one of whether the air shall be thrown away or used. Every little helps when added, but certainly does not when subtracted.

The Approaching Air-Brake Convention.

The Committee on Arrangements for the Fifth Annual Convention of Air-Brake Men, to be held in Baltimore, April 12th, is rapidly completing its duties, and the results will be published in detail in the columns of this department next month, which will be in ample time for those who will attend the convention.

Everything indicates a successful meeting and enjoyable trip. The committees are completing their reports, which are fully up to the high standard of former years. A canvass shows that even a larger attendance than at previous conventions will be had. The number of ladies will undoubtedly be greater than last year. Baltimore is a city of many sights, and less than an hour's ride from Washington, the capital, still richer in attractions to the sight-seer. Arrangements will be made for a special train to Washington.

Those wishing to attend the convention, whether members of the association or not, should apply at once to their immediate officials for passes. Prepare for the trip, and look for details next month.

A device, consisting of a number of link swivels and a coupling head, and making a flexible pipe, evidently intended to do away with the rubber hose, has been patented by a Michigan man.

Book for Air Pump Repair Men.

The most useful and complete treatise on air pumps is, beyond a doubt, a paper on "Air Pumps, Their Troubles and Treatment, and Tools For Making Repairs," which appears on pages 20-55 of the Air Brake Men's Proceedings. The committee that compiled the report is perhaps the strongest aggregation of air pump men that could be gotten together. Every air pump repair man should have a copy of the book. Paper, 50c. Leather, 75c.

Railroad Advertising.

The subject of properly and judiciously advertising railroad accommodation or any other commodity is one calling for careful study. Too much money can be spent in obtaining simply publicity, without getting the facts you wish to teach before the people you wish to impress them upon.

Mr. B. F. Horner, of the Nickel Plate Road, believes in impressing the public with the excellence of the equipment, dining car and sleeping car service of his road. He has recently issued a poster with three-locomotives in one hand. It calls attention to the improved service. The giant hand represents public patronage, and it grasps and holds aloft three of their monster express engines. Arranged in orderly confusion in the background is a multitude of travelers politely attended by the day-coach and sleeping-car porters; a corps of white-aproned waiters serving piping hot meals is also introduced to portray the excellent service available in their dining cars and depot restaurants. Their triple passenger service is symbolized by this advertisement, and thousands of these colored posters are sent to various ticket offices of their friendly connections and exhibited in this way to the traveling public.

Mr. Horner is evidently a man of the George H. Daniels type. He knows the value of advertising, and plans new and attractive forms.

The Pennsylvania road has adopted and put in use a device in connection with the steam fountain on the cab, that has some strong points to recommend it, both for safety and convenience. In brief, the fountain receives its steam from the safety valve dome through a supply pipe that has a globe valve located in it just outside of the cab and back of the dome. This valve makes it possible to shut off boiler pressure from the fountain at any time it is required to do work on any of its connections, and also reduce the liability of cooking people in case of rupture of the pipes in a wreck—that is, if the valve could be reached in such a contingency.

Rustler's Locomotive Supply Company

BY R. E. MARKS.

One of my old shopmates wandered in the other day, and as he seemed to be wearing pretty good clothes, a new derby and patent leather shoes, I wondered what he'd been up to, that he could sport good clothes. He used to be as hard up as I was—and am yet, for that matter.

"Hello, Rube," he said, "still in the roundhouse, I see. Well, I've graduated, I hope; but then a fellow never knows what's going to happen next week. What am I doing? Kind of a funny business, you'll say; but I believe it'll pan out pretty well, if we can keep afloat long enough.

"It's this way, Rube," said he. "You know I learned drafting at night-school, while you and the rest were out having a good time with the boys; and after I left here I went to the A. R. G. locomotive works and worked in the drawing room for some time.

"I saw the trouble that was caused by minor changes to suit some master mechanic or somebody else, and saw how much money was really being thrown away by this method.

"Then, again, the A. R. G. works had some mighty good features, and some not so good, and the poor ones had capped the good ones every time. That's another point.

"One day I went into a bicycle factory, not one of the big concerns where they make all the parts, but where they assemble parts; they buy wherever they can do the best—misfit wheels, some call 'em, but to my mind they are all right and the right way to do business. I talked to the superintendent and found out his ideas on the subject."

"He bought this make of frame because he believed it was good, and that make of wheels for a similar reason, and so on with his list of parts. 'Every maker,' he said, 'has some good points and some bad; buy the good and leave the bad for somebody else.'

"When I got home I thought of this factory until I found a plan which I could present to some men I knew who had money to invest and this is the result." He handed me a card as follows:

JOHN T. RUSTLER,
Rusher Building,
New York.
Mechanical Engineer,
"Locomotive Supply Co."

Of course, I wanted to know more about it, particularly as the boss wasn't around, and Rustler went on to explain:

"We have prepared plans of good, sensible engines, without frills or hobbies, for almost any class of work, except climbing trees or going to the Klondike. These engines are 'standard' in every way, according to the best practice.

"When we hear of a road likely to want engines, I go to the right parties with this little book of drawings and engines, photographed down for convenience, and submit my plans. Of course they kick—expect that—want a little different frill here or an eight-sided nut there, because they always have had. I say: 'Gentlemen, these are standard drawings of good engines, which we will guarantee in every way. Every change costs money, and doesn't secure any better results; if it did, we'd adopt it. We have these parts built in quantity and in duplicate. That makes them good and cheap. We get boilers built in one shop, valve motions in another, and have them assembled by our own erecting shop. We have no other shop, and don't want any—might get into hobbies ourselves if we did. Having our own erecting shop lets us know dead sure the work is right. If it isn't, it goes back in a hurry.'

"Then they want to know the advantage of the new scheme, and when I show them our prices they see it. Of course all don't take to it; but they're coming round to it, and when other stockholders hear of the money to be saved by buying engines of us, they'll demand them for their roads."

"But don't the other locomotive builders kick?" I asked.

"Sure—bound to, at first; till they see the benefits of the scheme to them. Of course, they don't want to miss seeing their name-plates on the engines, but aside from that they are better off. Don't need any drawing room scarcely, and saves them lots of traveling men. They'll be regular 'bicycle parts' factories after a while."

"But look here, Rustler," I said, "do you mean to say you've already done all you say, and that you're now building, or rather erecting, locomotives for all the roads in America? Strange I hadn't seen a word about it in LOCOMOTIVE ENGINEERING—that usually keeps me posted on new things."

"Well, no, Rube, not exactly; we haven't really got started. I was just telling what would be five years from now, if things go right; so don't give me away."

But the more I think of it, the more I wonder whether he was dreaming, or really has the germ of a good thing in that noddle of his.

False Engineering Notes.

A correspondent whose nerves are sensitive to a false engineering note writes us:

"Some men are born great; some achieve greatness, and some have greatness thrust upon them."

The latter part of this quotation would apply to enclosed clipping from a prominent newspaper:

"The master mechanic of the Chicago & Alton has found a new use for air. The rails are sanded by a device operated by air while the locomotive is in motion. The sand is blown on the rails whether the locomotive is moving forward or backward. A test of the mechanism was made last Saturday on passenger locomotive No. 94. It was found to give satisfaction, and it is now intended to equip all the iron horses with the new 'sprinkler.'"

It is the same brilliant genius, no doubt, who reports thefts of car brasses as a larceny of "brass journals." He should take some lessons in mechanics from the old colored man who on being asked by an eight-year-old aspirant for engineering knowledge, "What makes the steamers go, Uncle Pete?" answered, "Why, the force of smoke, chile!" or yet another Uncle Tom, who told a youthful inquirer that railroad trains went by steam, and that it was invented by George Washington.

When, Oh when?

A good-sized rumpus has been stirred up among the Western railroads on account of the Chicago, Burlington & Quincy's action in announcing a fast train between Chicago and Denver. The trouble, it appears, lies in the fact that the Burlington having considerably the shortest line between these points, can make the distance of 1,025 miles comfortably in the schedule of 28½ hours, leaving Chicago at 10 a. m. and reaching Denver at 1.30 p. m. the next day, and Colorado Springs and Pueblo that same night. The other lines, not being so fortunate, their mileage being considerably greater, cannot make the time and hence the threat of a declaration of war. The Rock Island mileage, for instance, is 1,093 miles; that of the Santa Fe 1,210 miles, and they naturally will make a strong fight to either prohibit the Burlington from continuing the fast service, or to force them to charge an extra fare for passage on the fast train. The Burlington people laugh at both of these suggestions, and reply that the public demand the fast service and that they are simply taking advantage of their superior facilities, and decline to be choked off by their less fortunate rivals; that the public will support them in the effort to give quick service between two such important points.

The amount of information conferred upon trainmen by the Westinghouse Instruction Car may be understood from the fact that during the time the car was on the Consolidated System of New England, instruction was given to 22,550 aspirants for certificates. The figures represent men who attended several times before they were able to pass, but there were over 7,000 individuals.

Some idea of the attention that the Baltimore & Ohio Railroad is now paying to its passenger traffic may be gained from the fact that during the past eighteen months nearly 800 passenger cars received thorough and ordinary repairs, 696 being repainted. Nearly all of the equipment is now "Royal Blue," and most of it is equipped with Pintsch gas, the Pintsch light being used on local as well as through trains.

The Schoen Steel Car.

In our August, 1897, issue we illustrated and described some steel cars built for the Pittsburgh, Bessemer & Lake Erie Railroad by the Schoen Pressed Steel Company. From reports recently received, we are placed in touch with the fact that other roads are going into the steel car very extensively, adopting the design of those already built from the plans of Mr. Charles T. Schoen, which have so admirably proved their fitness for the coal and ore trade.

The orders for these cars are all for 100,000 pounds capacity, except one which nominates the figure of 110,000 pounds. The light weight of the latter cars will be not over 34,000 pounds, which fact will be of interest to those who are nearly reaching this weight on their 60,000-pound equipment, and quite likely accounts for the investigation of the possibilities of the steel car by officials who have formerly taken only a lukewarm or indifferent view of its merits. The 100,000-pound cars now building will be only 26 feet long, and the ratio of gain in paying load over dead weight must be alluring to transportation officers.

This gain due to saving of dead weight is shown in figures furnished by the Schoen Company to be as follows: Assuming that train loads of 1,500 tons of paying freight are hauled, and that the wooden car weighs 16.5 tons, and the steel car 17 tons. To haul 1,500 tons, fifty wooden cars are required, weighing 825 tons. To haul 1,500 tons, thirty steel cars are required, weighing 510 tons. Dead weight saved per train load, in favor of steel cars, equals 825 — 510 = 315 tons.

SCHOEN 100,000-POUND DUMP CAR.

The general offices of the National Association of Manufacturers, including the office of the president, Theodore C. Search, have been removed from No. 1743 North Fourth street, Philadelphia, Pa., to the Bourse, Fourth street, below Market.

A Successful Ex-Engineer.

It may interest the "boys" to know that H. S. Peters, of Brotherhood overclothes fame, is having the success that comes with a never-ceasing hustle for business. That patent jacket pocket, from which it is impossible to drop a watch, is one of the most popular features of the Peters productions, and the pants for special wear on the engine are a close second.

About 100 dozen garments a week is the capacity of the plant at present, with thirty employés. The facilities and force are already too small for the increase in business, and an extension is an imperative necessity. Latest and best improved machinery known to the cloth worker is used in these garments, and that they cost money, it is only necessary to take the button-hole machine as an example. This machine that both cuts and works button holes, costs simply for the privilege of using it—they can't be bought—$100; besides this amount the owners levy a tribute of 1½ cents on the user of every 2,400 stitches made by the machine, which is about 1½ cents for every twenty-four button holes. The inventor too often fails to reap the reward of his genius, and it is to be hoped he comes in on this fat royalty.

In the course of an interview with a newspaper reporter, Mr. Cowen, one of the receivers of the Baltimore & Ohio, recently said: "You ask me what is the greatest need of the Baltimore & Ohio Railroad at this time. I answer 'Cars.' Of course, this is not the sine qua non, but cars are more needed than anything else. With more cars we can increase the net earnings of the road very considerably. Our net earnings for the last six months have been $3,900,000. They should have been $4,400,000. The reason why they did not reach the latter figure was because we had not the cars to haul the freight which was offered to us. Why, sir, a gentleman sat at this very desk not very long ago, in that chair, and offered me 6,000 cars of freight at $42 a car, full freight rates, and I was obliged to decline it. Mr. Carnegie offered me 3,000 cars of freight in one month, and I could not accept it because we did not have the cars with which to do the business. Since the pronounced revival of business in September we could have made additional net earnings to what we have earned of at least $125,000."

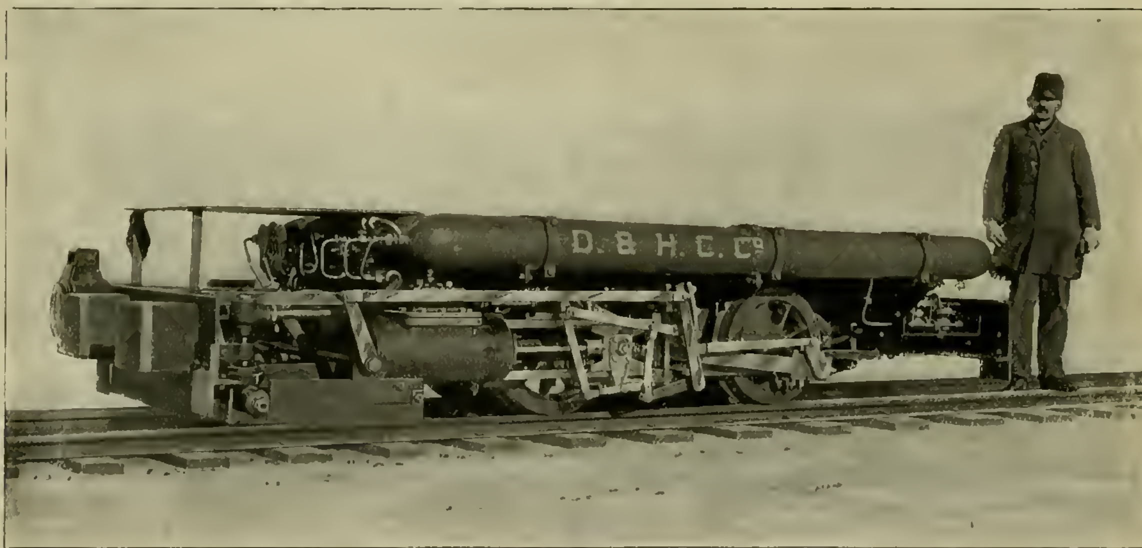
"Air Compressors" is the title of a handy little illustrated pamphlet recently issued by the Ingersoll-Sergeant Drill Company, of New York. It is devoted principally to giving the names of firms which are using the Ingersoll-Sergeant air compressors.

Parties interested in clean firing should carefully read "Combustion and Smoke Prevention," by Angus Sinclair. Only 25 cents.

Dickson Air Motor.

The remarkably small compressed air locomotive shown in the annexed engraving was recently built by the Dickson Locomotive Works for the Delaware & Hudson Railroad.

Writing about the motor, Mr. J. D. Campbell, manager for the builders, says: "It is but 36 inches high, and to work in the flat workings of the mine. I am going to send you a good photograph as soon as I receive it, and all the data in connection with it. The cylinders of this motor are 7 x 14; wheels, 24 inches; so you will see that we have succeeded in working in a large motor in a small space. The place usually occupied by links (the gage of this motor is 30 inches) is occupied by tubes to give the required storage capacity, which forces the valve motion on the outside—a matter I do not regret, as I find an excellent result in the use of this valve motion, which I know you are thoroughly familiar with."



DICKSON AIR MOTOR—SMALLEST OF OUR ACQUAINTANCE.

Some Interesting Facts About Steel.

The term steel signifies iron containing a small percentage of carbon, which may vary from less than 1 to 15 per cent.

In modern times steel signifies iron that has an infinitestimal amount of carbon in it, provided it is produced by the open hearth or Bessemer process.

Meteoric iron is a close representative of nickel steel, and was used by the ancients.

The majority of steel in the early times was obtained from wrought iron.

Wrought iron is produced from cast iron melted in contact with iron cinder and iron ore, and when cooled and worked again heated in closed vessels with shavings of horn and similar material.

The most important invention in connection with the production of steel was that of Sir Henry Bessemer, and termed the Bessemer process.

The Bessemer process dates back to the fifties. The essence of this invention was the production of steel from pig iron by the use of an air blast. A blast of air is forced through the molten cast iron so that the carbon and silicon contained in it are burned out, they forming the fuel. The converter in which the metal is treated by the Bessemer process is an egg-shaped vessel having a capacity of from several tons, which is turned on its side to receive the charge, and afterward brought into an upright position. Its bottom is full of holes, through which the air blast is forced.

Steel under the intense heat of a converter is as liquid as water.

In 1878 another great advance was made in the art by Mr. Sidney Gilchrist Thomas, by which ordinary grades of iron ore were rendered available for steel making. The Thomas invention related to the addition of a quantity of lime to the charge, and the lining of the converter with special bricks formed of lime which absorbed the phosphorus in the cast iron.

The slag obtained by the Thomas process is found to be rich in phosphorus, and is used largely as a fertilizer.

The Thomas improvement is the greatest yet made on the Bessemer process.

Following the Thomas discovery the next important improvement in the process was that made by William Siemens in 1882, which consisted in burning the fuel so as to produce a gas which was burned in a peculiar furnace, obtaining thereby high temperature and great economy of heat.

The tenacity of good steel is very high, exceeding that of any other metal.

The fractured surface of steel generally presents a crystalline appearance uniform in strength.

Much carbon makes steel close grained and lustrous.

Natural steel is obtained by refining cast iron so as to deprive it of a sufficient portion of carbon to bring it to a malleable state.

Indian or Wootz steel is made by melting one pound of malleable iron in a crucible with 10 per cent. by weight of the wood and leaves of the plant "Cassia auriculata."

Mild steel contains from 2 to 5-10 per cent. carbon. When more is present it is termed hard steel.

Steel in its hardest state is too brittle for most purposes, and the requisite strength and elasticity is obtained by tempering, which is performed by heating it to a certain color, dependent on the use to which it is to be put, and cooling quickly.

The tensile strength of steel ranges from 75,000 to 96,000 pounds. The average is about 86,000.

A hemp rope 16.5 inches in circumference would be the equivalent in strength of a steel rope five inches in circumference.—From "Riehle's Digest of Physical Tests."

We have received from Mr. Von Littrow, of Vienna, Austria, a great many handsome photographs of locomotives built in the locomotive works there. They form a sort of history of the locomotive as developed in Austria, and we expect to show them in our pages in the near future.

In the Creole Quarter.

The editor of our Air-Brake Department, Mr. F. M. Nellis, has a gift of story telling, as is testified by the following story, which he contributed to the January number of the *Cornell Magazine:*

"One night, about four years ago, I was strolling about the streets in the French quarter of New Orleans, enjoying, as only a stranger can, the many interesting sights of that quaint old place. After considerable time spent in sight-seeing, I was warned by the growing scarcity of people on the streets that it was getting late, and that I had therefore better look about for a lodging place for the night.

"About midnight I came to a little hotel where I decided to stop. I registered, and was about to enter the elevator to go to my room when the clerk called to the negro bell boy who accompanied me. The boy returned to the desk, where I observed the clerk speak to him in a suspicious undertone. While going up in the elevator I chanced to turn my head quickly, and caught the boy scrutinizing me sharply. I again caught him in the same act as we were leaving the elevator.

"Entering the room to which I had been assigned, I observed that the negro boy began to assume an unusual loud tone of voice in conversing with me, as though he desired to attract my attention to him and thereby to keep me entertained. As he lighted the gas he began to whistle merrily, and continued as he opened the shutters and lowered the sash of one of the great, long windows. As he left the room he bade me good night, and gave me another of those suspicious glances.

"The room to which I had been assigned was capacious and of irregular form, having numerous corners and two little alcoves. The furniture was old-fashioned and massive. A huge chandelier, decorated profusely with old-fashioned glass prisms, hung from the high ceiling. Near the center of the room was a pillar or column about three feet in diameter, evidently supporting a heavy weight. The floor was covered by a rich but well-worn velvet carpet. The most prominent feature of the room, however, was the old-fashioned, massive, hardwood bedstead, overhung with a canopy and enclosed by dark-colored, heavy curtains. Numerous oil paintings, presumably old ancestral likenesses, adorned the several walls. Withal, the room more closely resembled the guest chamber of the typical Southern mansion than a hotel apartment. It had the general appearance of a room which, for some reason, was not regularly occupied.

"As I parted the curtains to get into bed, the weirdness of the surroundings and my recollection of the suspicious acts of the clerk and bell boy produced an uncanny feeling within me that I was loth to admit. That this feeling was justified, was proved by subsequent experience.

"I was lying in that delightful semi-conscious state which precedes sound sleep, when I was suddenly aroused by a piercing shriek near the foot of the bed. Terrified, I sat up and listened. I could hear nothing, and therefore concluded that my late and unaccustomed French dinner had unduly enlivened my imagination. I lay down again, and tried to go to sleep. Again came the fearful shriek. This time it was accompanied by a clanking of chains, and died away in a pitiful wail. I was thoroughly aroused. Horror-stricken, I sat upright for a moment, then sprang through the curtains to the floor, and quickly lighted the gas. There was no further sound. Neither was there any trace of anyone having been in my room. There was no doubting it now: the house was haunted. A deep stain in the velvet carpet and on the adjacent wall several bright spots which had hitherto escaped my notice, were easily believed to be the blood stains of some unfortunate person who had been foully murdered in this room. The acts of the clerk and the bell boy, as well as the general appearance of the room confirmed it. Again came the awful shriek, louder and more piercing than before. This time it was right behind me, the gas now burning brightly from all eight burners of the chandelier. This was more than I could stand. I felt a dizziness coming over me. My vision grew dim, and I sank half fainting into a big oak chair. Once more came the fearful sound, this time from behind the column towards which I was actually gazing. I felt my strength going, and fought hard. The thought of losing consciousness at that time, and in a haunted house, gave me strength to make one more effort to discover the ghost. I staggered towards the column, and leaned, weak and exhausted, against it. Once again, and more piercing than ever, came the horrible shriek, this time right in my ear, which lay against the column. I was fast losing my senses, and as I clung to the column, sinking to the floor, the awful sounds were repeated in my very ear in quick succession and with increased force. I felt a tremor in the column as I fainted dead away at its base.

"How long I lay there I do not know. As consciousness slowly returned, I staggered to the door and called excitedly down the elevator shaft to the clerk to come immediately to room 13. The grinning bell boy responded. When he saw me, however, the grin on his face changed to a frightened look, and he went down the stairs four steps at a time to the office. The clerk soon appeared, as did several aroused guests in various degrees of undress. With much labor I told my story, while the frightened guests huddled together and the clerk smiled exasperatingly.

"He explained that the column in the middle of the room was hollow, and on account of its close proximity to the elevator shaft, was used as a secondary shaft through which the counter weights and chains of the old-fashioned elevator were carried. The yellow pine, of which the columns were constructed, contained pitch, which, unforeseen in the construction, produced a condition between the inner walls of the column and the iron counter weights, similar to that between a well-rosined bow and a fiddle string. As the elevator moved up and down, the counter weights rubbed against the inner walls of the column, producing the sound. This, he explained, sometimes bothered nervous persons, but was no annoyance at all to sound sleepers. For this reason guests were never assigned to this room except when all other rooms were occupied.

"I slept the remainder of the night with a kind old gentleman, a guest of the hotel, who took unusual pains to convince me that there was no such thing as a ghost."

In the Early Days of Railroading.

"Railroading has changed some since the early sixties," remarked the retired engineer, "and when I came over from Philadelphia the other day, with the block signals, four tracks and close headway, I thought of a little incident, and accident, too, that happened on the D., L. & W. road in 1861.

"I was pulling a coal train out of Scranton, going north, and the head brakeman, poor Charlie Thomas, had brought his wife along for a trip over the road—riding in the caboose, of course. He was back there with her till we struck the down grade, and then he started out over the coal cars toward the engine.

"Running coal cars isn't a snap for anyone, and I don't s'pose Charlie was thinking so much of the coal cars as he was of the little woman in the caboose, waiting for him to come back.

"Well, in some way he slipped down between the cars, and half the train went over both legs above the knee. None of us knew it till the caboose got to him, and he called out to his wife. Then the conductor grabbed the bell rope, and I stopped quick as I could.

"They lifted Charlie into the caboose, and I started for the nearest sidetrack, put the cars in, and had the conductor wire Scranton for an order to 'wild-cat' home. We got it, and taking the caboose behind the engine, we lit out for Scranton as fast as the old 'Investigator' could roll off the miles.

"They made Charlie as comfortable as possible, and his wife held his head all the way to Scranton. Then we got him to the hospital as soon as possible, but he only lived four days. 'Twas hard on the little woman, too; but the boys came up handsomely, and got together enough money, so she didn't want for necessities.

"But the strange part of the railroading end of it was being able to get orders to 'wild-cat' back over a single-track road. Couldn't do that now. But, then, there wouldn't be so much need of it, because doctors are thicker than flies in all towns, and hospitals are not as far apart as they used to be."

Columbia College.

A visit to the engineering departments of this institution of learning right here in our midst afforded an opportunity long promised, to see for ourselves just what there was in the claims of its friends, that Columbia was not playing from a second violin score, in the music she was making in the matter of technical education. Under the escort of genial Professor F. R. Hutton, than whom there are none more enthusiastic, and who knows how to impart a galvanic action if there is the faintest sign of animation to work on, we revelled to satiety in all forms of engineering—mechanical, electrical, mining and bridge.

The models used to illustrate a principle in each of the branches taught comprise almost everything in the study of engineering. and are among the best we have seen. To particularize in the electrical exhibit, there is what is aptly called an Analogue used to demonstrate the fall of potential in an arc system, showing graphically how losses occur, by means of a small rotary pump which forces a colored fluid up through a series of glass tubes, making plain the loss of power by the reduction in head of the fluid. There are three of these analogues used for differing phase systems.

In the drafting rooms, which are models of their kind in arrangement with reference to daylight and furnishing, there is every incentive to good work, because of the fact that there is no crowding; everything is on the most liberal scale, giving evidence of designs on the future in the development of to-day. An ingenious and effective system of lighting by lamps is in use in the drafting rooms, by which a diffused and subdued light is obtained. It is had by means of opaque conical reflectors about 36 inches in diameter, placed under the lamps, which are suspended from the ceiling, the reflectors being suspended from the lamp with its concave side up, so as to cast the light to the ceiling, which in turn reflects it down to the tables.

The lecture rooms are gotten up on the same liberal lines in point of convenience, the chairs having an arm rest of such a width as to comfortably hold a book or note pad, and the whole arranged in semi-circular form about the rostrum. There is a very complete installment of electricity here, all power used in the institution is from that source, the elevators and monster ventilating fans being handled by it. These fans are governed by a thermostat, which by electric contact handles the dampers in the stack and thus controls the air. In the basement is located the dynamo room and alternating current plant for experimental study.

A most interesting feature of the mining department are the models of existing mines, both in section with the different strata penetrated, shown in color, and also at a smaller scale in which the shafts, driftings and slopes are very realistic. In addition to these are other models showing a mine complete in elevation, the workings being shown by solids in skeleton form. The handling of ores and separation is made plain by means of the actual operation in large concentrators.

The laboratory for physical tests of materials is receiving some extra attention at this time, which has for its aim a big improvement in facilities for doing work. The large laboratory—the pet of the engineering fraternity—is 210 feet long by 35 feet wide and 21 feet high. This great room is divided by imaginary lines into three parts, one of which is devoted to the magnificent hydraulic machinery presented by the Worthingtons, the opposite end by the big Allis-Corliss compound, by gas and other engines, and the middle bay will be devoted to experimental locomotive engineering, which feature it is the intention to make second to none. The preliminaries are all settled for the installation of this locomotive testing plant, and the engine will be located as quickly as proper arrangements can be made for its reception. We understand that the Baldwin Locomotive Works have donated their locomotive "Columbia" to this laboratory. This, by the way, is the most recent coup sprung upon us by the indefatigable professor in charge, named above, and who is secretary of the American Society of Mechanical Engineers; that it will go, there is no room for doubt. There is one very urgent need asserting itself in this department, and that is a traveling crane to run the full length of the room. Here is an opportunity for enrollment on the scroll of honor, of the lucky donor's name.

Here were found two most interesting relics, snatched from the junk man to have a place of respectable abode and show posterity what was going on in the mechanical world in their respective lines in the early seventies. One of these is a complete locomotive and tender, built on the model of the so-called "Blood" engines of that time, at a scale of one-quarter size. The engine is a beauty, having been modeled after the best passenger practice of that time. All the distinctive features of construction of that period are quickly recognized by the old-time railroader, such as balloon stack with cone and netting, plugged cylinder cocks that were opened and closed from the ground, and the old-fashioned pumps on each side. Those who attended the exposition of 1876 saw it running, and they still turn her wheels at the college, by means of compressed air, just to limber her up once in a while. The other relic is a small slide valve engine, on which is the first shaft governor ever built; this engine was made by the late J. C. Hoadley, and had other original points about it, the most peculiar of which was a ball-jointed arrangement of the bed or frame, at the crank end, by which the engine could be made a vertical or horizontal at will. It was the product of a master, for it looks fully equal to the best work of to-day in respect of modern features of engine design.

In the manual training department there is rather more attention paid to the character of work turned out, than is the case in most instruction of the kind, the lesson being thought to leave a most lasting impress when the cunning of the hand is an ally to the crammed brain. The wood working instruction consists of pattern-making, and by that is meant practical work that can be molded and will draw out of the sand. The shop for this work is well equipped, having the regulation pattern-makers' benches, rip and cross-cut saws and wood turning lathes. In this room was seen a blackboard built in the wall, and having its whole surface covered with faint lines forming squares 1 inch wide horizontally and vertically, thus making a gigantic profile board. The advantage of such a board is apparent at once, since a freehand drawing or sketch can be made fairly accurate to scale, either reduced, full size or enlarged.

No less efficiently equipped is the iron-working shop, which has several sizes of lathes, planers, drills, grinding machines and turret screw machines, all of the best builds and latest output. It was in this shop that they had tenderly laid away another link between the past and present, in the shape of an antiquated hand crank planer. This old tool was literally snatched like a "brand from the burning," for it would have found its way to the cupola if they had not stretched out a saving hand to preserve it to the future as a curio. The foundry is nicely equipped for small work, and is in a state of development for more extensive operations.

There is a power plant in connection with this institution that is entitled to rank away up at the top, in respect of its adaptability to present needs and those likely to demand attention in the future. In keeping with its surroundings, it is on the grandest scale. There are ten batteries of 200 horse-power each, Babcock & Wilcox boilers, in one of the neatest kept boiler rooms we have ever seen. This cleanliness is largely, if not wholly, due to the Hunt system of handling the fuel and disposing of the refuse. The power consists of two simple Allis-Corliss engines of 200 horse-power each, and two Armington & Sims compound engines of 100 horse-power each. All these engines are direct connected to the dynamos, which furnish the electricity for everything.

There are few places of greater interest to those with a penchant for mechanics or a love for the beautiful and grand, than Columbia College. The library, a present from its president, Mr. Seth Low, is alone one of the sights of this country, and well worth a day to admire the magnificence of its marble.

A Time of Danger.

At a small railway station in the hilly part of Alabama, an old man, carrying a carpet-bag and accompanied by his wife, boarded the train. They took the first seat, the old lady sitting next the window. It was apparent that this was their first railway journey. The train started, and they both looked eagerly from the window, and, as the speed increased, a look of keenest anxiety gathered on the old lady's face. She grasped her husband's arm and said, in a voice plainly audible to those about her:

"Joel, we be goin' awful quick. I know 'tain't safe."

A few minutes later the train ran on to a long trestle. With a little shriek of terror the old lady sprang to her feet and seized the back of the seat in front of her. There she stood, trembling from head to foot, staring from the window. Meantime the train sped onward and was once more on solid earth. The old lady was quick to note the change. Her features relaxed and she sank into her seat with the fervent exclamation:

"Thank goodness! She's lit again."

With the return of prosperity, railroad companies are again considering the equipping of their lines with block signals, a form of enterprise that has been almost dead for five years. In this connection we might mention that Elliot's book on "Block and Interlocking Signals" ought to be in the hands of every man who has anything to do with block signals. It is the most comprehensive work of the kind ever written. For sale in this office; price $3.

The Sargent Company, Chicago, have recently published the second volume in their series on the Diamond "S" Brake Shoe, giving the results of the remarkable tests of this shoe, which were conducted on the brake shoe testing machine at the shops of the Westinghouse Air-Brake Company, at Wilmerding, Pa. They will be pleased to furnish copies of these pamphlets, together with results of service tests, to all railroad men, upon request.

The Baldwin Locomotive Works are building some two-cylinder compound locomotives for the Norfolk & Western Railway; cylinders, 23 and 35 inches diameter by 28-inch stroke..

The World's Railway.

There have been so many inquiries for the "World's Rail Way" from men who are unable to pay the whole price at once, that we have determined to offer it on the instalment plan. We therefore will send the book on receipt of $2.50 and an agreement to pay $1 monthly until the whole price of $7.50 is paid.

Persons willing to do some extra work to secure the book, can have it if they send in twenty-four subscribers to Locomotive Engineering. It does not take much work to get a club of that number.

The Nicholson File Company, of Providence, R. I., acting through the Great Western File Company, of Beaver Falls, Pa., its Western branch, has just leased for a term of years the plant and good-will of the McClellan File Company, of Saginaw, Mich., makers of the McClellan brand of files and rasps. The Nicholson Company will continue the manufacture of the McClellan brand in connection with its Great Western brand, the product of its Great Western branch. With this addition to their plant, the Nicholson File Company now control and operate five distinct factories, with a joint capacity of 6,400 dozen, or 76,800, files daily, representing about 70 per cent. of the entire production of files and rasps in the United States.

A very interesting paper was read at the February meeting of the Western Railway Club by L. R. Pomeroy, the New York sales agent of the Cambria Iron Company, on the "Coffin Toughening Process, as Practiced on Axles, Crank Pins and Other Materials Going into the Construction of a Locomotive." The paper was replete with information on a subject but vaguely understood by the average users of steel for railroad purposes, and will occupy an important place in the literature of steel treatment.

The Buffalo Forge Company have recently received an order for the blowers and engines required for revenue cutter No. 6, building by tbe Columbia Iron Works & Dry Dock Company, Baltimore, Md. This engine is of the double enclosed upright type. The fan is a special and peculiar discharge machine, which only is adapted to limited space.

The Boston Belting Company have received a most gratifying testimonial from Mr. James Burke, chief of the Fire Department of Memphis, Tenn., regarding their carbolized rubber fire hose. He appears to have had considerable experience with this kind of hose, and is very enthusiastic in its favor.

How a Case of Lightning Repairing Ended.

BY JOHN T. USHER.

Several years ago I was working in one of the division shops of P. R. & T. Company. The work was nearly all repairs there, with occasionally a new engine to fill up the time when things were dull.

We had a general foreman, Mr. Torker, who attended to the office work and supervised the machines and machine work; and a pit foreman, Dan Werker, who supervised the floor work; and besides, there was a man in charge of each of the several pits, the writer among the latter.

Things had run an even course in the shops for many years without anything to disturb the monotony, until one day the news came that the general master mechanic and superintendent of motive power had passed away. This news was followed by that indefinable feeling of uncertainty and uneasiness which always prevails on such occasions. Nobody in the "D." shops entertained any hopes of being benefited by the changes that were likely to occur, but there were several that expected to be reduced in position, or to be removed altogether, if things took an unfavorable turn, and amongst these was Mr. Torker, who was undeniably holding his position through favor of the division master mechanic.

As soon as the first excitment had subsided, Torker commenced to bestir himself, and to hurry the men and the work to such a degree as to disconcert the whole department. But he was determined to secure himself and to gain the good will of the new superintendent. He introduced some startling innovations. The driving boxes were bored large, and we were instructed to just scrape them a little on the crown. The side fit didn't amount to anything. Connecting-rod brasses were to be fitted loose, so they wouldn't heat. It wasn't necessary to fit the driving-box wedges; planing was good enough for them.

It had become customary in the shop to always turn out an engine at the end of the fifth week after it came in. Some of the engines that came in did not require five weeks to put them in order, while some of them would have taken six or eight weeks with an ordinary pit gang. Werker had to arrange matters by taking some men off the short-time engines to increase the number on the long-time engines; so that the number of men employed on each engine was just enough to finish it by the end of the fifth week.

The first two engines turned out under Torker's improved methods were finished ready to be run out and tested in four weeks, and proved to be a rattling success. Though it was somewhat discouraging to Torker to think that it took him and his men another week to really finish up the engines ready for the road, making the time just five weeks, and with the workmanship being—well, it is better to say nothing than to say either too little or too much.

Just about this time Werker met with a painful accident that disabled him for several weeks. This afforded Torker an opportunity such as he ardently desired to give full scope to his talents. Nor was he slow to embrace it. It was a case of now or never with him, and he knew just how to take advantage of it.

Torker had an engine brought in right away. Then he selected a gang of worthies (every one of foreign birth, not an American among them), and placed Jim, a blustering, blackguardly bully, in charge, with instructions to push it along, as he wanted that engine turned out in three weeks. This was Jim's first (and last) charge.

There was a warm time around pit No. 2 during the next three weeks. The air was not exactly blue, but it was considerably discolored, and there was such a flow of unwritable language as is seldom heard outside of Ellis Island. Jim pushed things along. Everything was a good tight fit this time, for although the two former engines had proved such "rattling" successes, yet Torker was hardly satisfied; hence the change. The reversing gear pins were all driven in with a sledge, and everything else was fitted proportionately close.

The engine was finished ready to be run out and tested in two days less than the stipulated three weeks. Torker was in his glory; said a great many things the truth of which he had so aptly demonstrated.

The engine was run out upon the transfer table, with Jim and a couple of other select men to test it. Steam was raised; and with a creaking and groaning that suggested chronic rheumatism in some of the parts and a complete case of ankylosis in others, the engine started off. They made the switches all right, and got onto the side track, which was used for little else than testing purposes. Here they could have a clear run of fully three-quarters of a mile.

Torker told Jim to "open up and let her spin," that she would limber up before she had made the first quarter of the run. He then dismounted. Jim opened up, and she commenced to spin, slowly at first, but presently the rods bent to their work. They did bend, too, first one way then the other; until finally she actually did limber up, and commenced to spin in earnest; and as she went by the shop at full speed there was a buzz of excitement, probably not unmixed with admiration. Still the engine sped on. She covered the first quarter of a mile all right, and the second one also. Then Jim thought it was time to ease up a little; but to his dismay found the throttle valve wouldn't budge. It was stuck tight, and with a full head of steam on, too. Something had to be done, and that quickly, as they were nearing the end of the run. Jim reached over for the reversing lever; but here again, to his utter consternation, he found that stuck, too; nor could the united efforts of Jim and the select men move either the throttle or the reversing lever. They applied the brakes; but though they worked all right, it only seemed to make matters worse. Then there was a scramble to save themselves, which they did by jumping—and only just in time, for the next moment the engine went over the "bumper" and embankment, ploughed its way across a street, then down the river bank, and stopped on the edge of the Mississippi.

It took five engines two and a half days to pull that engine back onto the track again. It was hauled back into the shop. But no one was allowed to examine it; Torker reserved that for himself. And he and Jim stayed that night until 12.30 dissecting the throttle and its connections.

The next morning they exhibited an oblong piece of brass which they claimed to have found in the cylinder, in the head end, and explained how it must have been left in the "dry-pipe," then been carried along by the steam and got wedged in between the throttle valve and its seat. Sure enough, there was a slight indentation on the valve seat and a somewhat brassy look around it; but there was no corresponding indentation on the valve face, neither did the piece of brass look as though it had undergone much rough usage.

That must have been a wonderful piece of brass. Just think of it. It measured ¼ x ¾ x 1 inch. And if the above theory was correct, it had been squeezed through a throttle valve whose maximum opening was only ⅜ inch. No wonder it got wedged in. But how did it squeeze its way through, and how did it remain unaltered in the head-end of the cylinder when the clearance was less than ¼ inch?

Torker never undertook to explain why the reversing gear failed to work. I suppose it was a case of "didn't have to."

Werker's opportune return put an end to Torker's further endeavors to break the records for overhauling engines. But it did not prevent many of the best hands in the shop from seeking positions elsewhere.

The Davis & Egan Machine Tool Company, of Cincinnati, O., have purchased from the Morgan Engineering Company, of Alliance, O., a 25-ton electric crane with 50-foot span, which will be placed in their new plant at Covington, Ky. They have also just received an order for a large number of lathes, planers, shapers, bolt cutters, drill presses, radial drills, screw machines and brass-working tools, amounting to $10,000, from Julius G. Neville & Co., of Barcelona and Madrid, Spain.

As a measure of economy in train operating to save the expense of one crew, the Panhandle last month tried the experiment of running two trains in one section with double header. Someone figured that it was going to make a saving of between $3,000 and $4,000 a year. The trains as made up generally consisted of fifteen cars, five of them heavy sleepers. The experiment did not work well. One day the train arrived three hours late, the delay having been caused by breaking in two five times and pulling the drawbar out of a mail car. This kind of economy did not strike the general manager as a good one to follow, so orders were given to return to the plan of running the train in two sections. The intimation was given that safety could not be sacrificed to an overwhelming desire for economy.

A series of articles on "Locomotive Link Motion," contributed by Mr. F. A. Halsey to the *American Machinist*, is to be combined with a previous book on "Slide Valve Gears" by Mr. Halsey and published by LOCOMOTIVE ENGINEERING, under the name of "Locomotive Link Motion." In order to enable every engineman to have a book on valve motion at a small cost, the publishers have determined to sell this book for 50 cents.

A very handsome illustrated catalog has lately been issued by the Morse Twist Drill & Machine Company, of New Bedford, Mass. The book is devoted principally to giving the illustration and price lists of all kinds of drills, reamers, taps, dies and the various well-known specialties made by the company. The illustrations are excellent, and give a good idea of the various forms of goods made by the company. Shop foremen will find this a very useful reference to order by.

The Boston Belting Company have placed upon the market a spiral round piston and valve-rod packing which they designate as Nox-all. This packing is made in the form of a continuous spiral coil, and consists of a round, red-rubber core, surrounded by layers or plies of specially woven duck, and the outside is thoroughly coated and lubricated with a select grade of fine plumbago entirely free from acid or grit.

The chainless-wheel craze has now reached the stage, where a patent has been granted to a man who wants to belt the main sprocket to a dynamo, run wires back to a motor under the saddle and belt down again to the rear wheel from the motor. This adds two belts, two electric machines and much weight in the endeavor to "simplify" the bicycle, but it does away with the chain. It's a good deal like some of the attempts to improve the link motion.

Burglar-proof mail cars have been built at the Topeka shops of the Atchison, Topeka & Santa Fé Railway. They have no end platforms, and the doors are fitted with heavy bolts, bars and chains, while the windows and ventilators are fitted with bars. A secret receptacle has been provided for the safe carriage of registered letters. Besides these precautions against the entry of unauthorized persons, the cars in equipment and finish are model railway post offices. An extra amount of table room has been provided. The letter cases have patent label holders and wire bottoms. The cars are lighted with seven Pintsch gas lamps, and there are fittings for temporary lights in case of emergency. The cars are 60 feet long, and were built after designs furnished by the Post Office Department.

We learn from the Sargent Company, of Chicago, that their Diamond shoe, which was illustrated and described in a recent issue of LOCOMOTIVE ENGINEERING, is making rapid progress into the favor of railroad men. Mr. W. D. Sargent, the vice-president and general manager of the company, has recently been on a visit to Europe, and, in spite of the proverbial conservatism of foreign railway managers for American inventions, the merit of the shoe seemed so clear to them that several of the railroads in England are already using it, and the prospect of a large extension of the business is very flattering.

Tests were recently made by a celebrated French mechanical engineer to ascertain the work expended in the propulsion of a bicycle. It was found that at ten miles per hour the work per semi-revolution was 18.58 foot-pounds, and at twenty miles an hour it was 63.62 foot-pounds. From this it would seem that the work of propelling a wheel at twenty miles an hour is more than three times as great as the effort expended to keep it running at ten miles an hour.

One of our agents at Farnham, Can., lately expressed regret that Prof. Gilderfluke's locomotive has not been sent into the snow-infested regions this winter to clear the tracks of snow. He says that the study of the engine has been very popular with trainmen, and we can testify that this study is not confined to trainmen alone, nor to the American continent. We have heard very pleasant expressions about it from various parts of the civilized world.

We have received from the Brady Metal Company, of 100 Broadway, New York, a very handsome pocket-book, with the name of each recipient printed on. It is one of the handsomest presents we have ever seen given away by a railway supply firm. Those railway men who have not received the book ought to send their cards to our genial friend, Mr. Dan M. Brady. It will be a gentle reminder not likely to be overlooked.

There is quite a stir in some railroad circles about the Pennsylvania Railroad having ordered from the Schoen Pressed Steel Company, of Pittsburg, 200 steel coal cars of 110,000 pounds capacity. Some railroad managers are in a constant state of nervousness lest they fail to keep in line with what the Pennsylvania Railroad has done, and we may now expect a rush towards the use of steel cars.

The Boston & Maine Railroad are considering the advisability of putting electric power into their railroad shop at Lyndonville, Vt. It is said that the power will be furnished by the city, who own the electric plant, for $20 per horse power per year. The plant runs by water power.

Readers of books and those having to apply to books for information, ought to have our "Book of Books" within easy reach. We send it free to those who ask for it.

Locomotive Injectors.

At the January meeting of the Locomotive Foreman's Club, Mr. G. A. Bischoff, of the Nathan Manufacturing Company, read a paper on "Locomotive Injectors." The following are extracts:

CAUSES WHICH PREVENT INJECTORS FROM WORKING.

In this direction there are principally two general conditions to be considered.

1. The injector refuses to lift promptly or to lift at all. This may be caused by leaky joints in the suction pipe; by improperly packed water valve stems; by dirty, clogged up strainers; clogging of the lifting steam passages in the injector; hot suction pipe, etc., etc.

In connecting an injector, either when new or when it has been taken off for repairs of some kind, particular care should be exercised in testing the suction pipe for tightness, by well known methods.

Particular attention should be paid to the strainer; it should be taken out, examined and cleaned before each trip of the engine. "An ounce of prevention is sometimes preferable to a pound of cure." Cheerfully undergoing a little trouble may be the cause of preventing a good deal of annoyance, anger and expense.

Hot suction pipe is usually the result of leaky steam valves or leaky boiler checks. If you notice any leaks in either, have them attended to without delay. The longer repairs are put off, the more aggravated will the trouble become, and the higher will be the cost of repairs, not taking into consideration the danger of something serious occurring during a run, as a result of neglecting timely repairs.

2. The injector lifts the water, but refuses to force it into the boiler, or forces it partly into the boiler and partly through the overflow. This may be caused by insufficient water supply as a result of improper size of the suction pipe, hose or tank valve opening, by clogged-up strainer, obstruction in the nozzles (pieces of coal, scale from steam pipe, waste, etc.), insufficient opening of the boiler-check, "sticking" of the boiler-check or of the line-check valve of the injector, by insufficient steam supply or wet steam. The pipes of an injector should never be smaller than the size called for by the injector connections, more especially the suction pipe and the clear openings of the tank valve. Sharp bends in the pipe should be avoided as much as possible. In piping an injector, the pipes, but more especially iron pipes, should be thoroughly blown out before connecting up, to remove scale and dirt from the pipes.

The "sticking" of the boiler-check or of the line-check valve is mostly caused by sediments and scale resulting from bad water. Incrustation of the nozzles by limey deposits around the points of the nozzles will also cause the injector to spray at the overflow, and result in improper action generally. The effects of bad water may be partly, if not entirely, eliminated by cleaning the injector frequently, and by placing it occasionally into an acid bath.

Injectors work best with dry steam, for which reason the steam supply pipe should be attached to the highest point of the boiler. If steam is taken from a fountain to which other steam appliances are connected, the volume or cubic contents of the fountain must be large enough to more than amply supply all appliances connected to same.

SUGGESTIONS.

Designers of locomotive engines, as a rule, do not pay that attention to the injector which its importance calls for, and beyond specifying the type and size desired, hardly any other attention at all is paid to its most desirable location and other points, with a view to assisting in the development of the best qualities and assuring reliable service. Injectors, as any other product of human endeavor, are subject to defects and failures; the very mechanical nature of the instrument calls for considerations in its arrangement and that of its accessories, which when properly considered at the time of building the engine, would go a long way toward preventing annoyance, expense and sometimes serious inconvenience. It is perhaps within the province of this paper to point out some features in this direction.

THE WICKED STRAINER.

The little conical copper strainers inside of the suction pipe should be abolished, as they are a nuisance and the cause of more trouble than they get discredit for. If a premium had been put upon designing something to readily catch and retain any dirt in such manner as to materially reduce the water supply, these strainers would undoubtedly receive first prize. The very fact that they are inside of the pipe is objectionable. The strainers should be outside of the pipe, either directly below the tank valve or well, or at the end of the suction pipe, between pipe and hose. The size of the strainer should be such that even if half filled with leaves or other matter it should still retain the full pipe capacity. It should also be so designed that it could be readily cleaned at any time and in a very few minutes. Such strainers can be obtained in the market, and their cost would be more than compensated for by avoiding troubles often caused by their absence.

PUT CLOSING VALVE IN SUCTION PIPE.

Some types of injectors are not provided with any water valve in the suction pipe. In cases where such valves are provided for in the injector, they are not considered as shut-off valves, but merely as regulators, by means of which to regulate the supply of feed water at certain pressures. For this reason some of these valves are so constructed that they will not form a tight joint when closed down. It happens then, occasionally, that in case of an accident to the boiler-check, which prevents its tight closing, and with the line-check valve of the injector leaking, the water cannot be kept in the boiler, and the engine must be side-tracked. To provide for such emergencies, it would be very advisable to place a properly sized shut-off valve in the suction pipe, between pipe and hose. With such valve at hand, and with the overflow of the injector closed, the water could not leave the boiler.

PLACE THE INJECTOR INSIDE THE CAB.

It is a very usual, but not a good practice to place injectors outside of the cab, and run long operating rods from the injector handles into the cab. These extension rods, as a rule, are not connected up very carefully, and even if they are, the injector cannot be as readily started or as well regulated as when the operating handles are close to the injector, and therefore under better control of the operators. The result of this arrangement is a waste of time in starting the injector, and considerable waste of water through the overflow. Very often the overflow cannot be observed, and the operator judges by the sound whether the injector operates properly or not, and with some types of injectors he is compelled to "feel" the suction pipe in order to convince himself of the operative condition of the injector. All this cannot be conveniently done with the injector removed. The proper position of the injector is inside of the cab. Room can always be provided for it. The objection of the overflow splashing or the steam clouding the windows of the cab, can be overcome by providing a larger overflow pipe than is usually employed. With a large enough overflow pipe, the overflow connection can be made perfectly tight.

Most of the trouble with injectors comes from improper, slow lifting, especially when the water in the tank is low, caused by circumstances for which the injector proper is not responsible, such as bad boiler checks, leaks in the suction, obstructed strainer, etc. To reduce inconveniences from this source to a minimum, injectors should be placed as near to the water level in tank as possible. On some roads the admirable practice prevails of placing the injectors a foot or two below the highest level of the water in the tank. The ideal in this direction is the "non-lifting" injector, placed below the lowest water level in tank: not only because the source of most of the trouble with injectors, the lifting, is entirely eliminated, but because by keeping the injector submerged in water, it will be kept comparatively cool, the precipitations from bad water will not be "baked" on, and the injector will wear considerably longer without repairs.

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Southern Railway Ten-Wheelers.

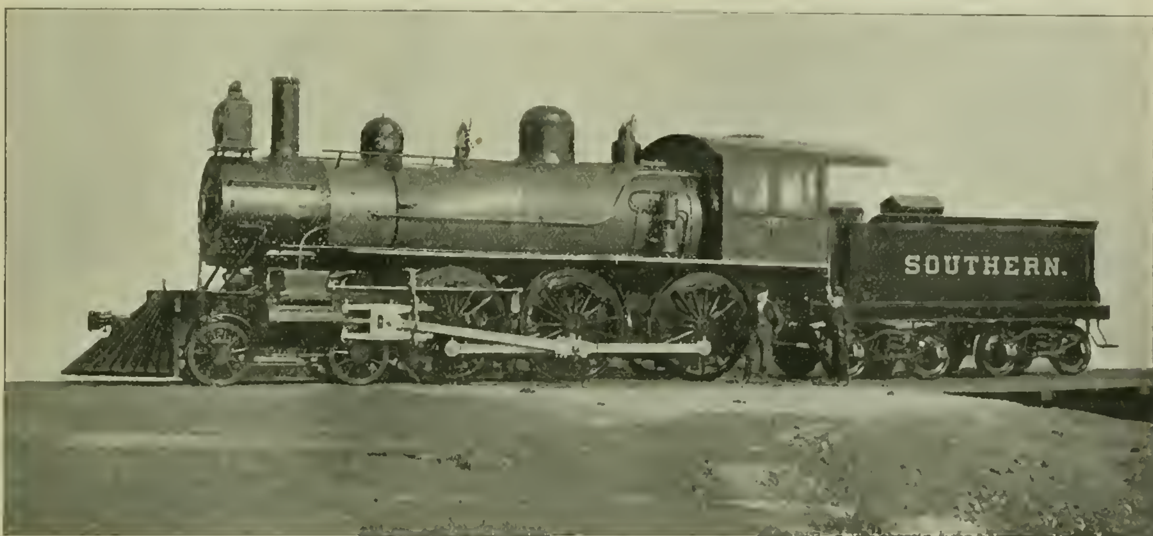
The Southern Railway has recently received two heavy passenger locomotives from the Richmond Locomotive Works. These ten-wheeled engines were designed by Superintendent of Motive Power Thomas, of the Southern system, to haul the heavy flyer, the "Southwestern Limited." As shown in our half-tone, which conveys a sense of power as well as beauty, it is seen that these engines are meant for work, of which they will find evidence of most careful consideration of parts likely to fail under long and hard service. The tender has a water capacity of 4,500 gallons, and a coal space to cover all needs in that direction. The tender frame is of heavy channel steel. A general description of the engine is given herewith:

General description:
- Type of engine—Ten-wheeler.
- Class of traffic—Fast passenger.
- Standard Gage.

Total engine—26 feet 1 inch.
Total tender—17 feet 3 inches.
Number and order of wheels having blind tires—Second driver.

Weight in working order:
- On drivers—121,250 pounds.
- On truck wheels—36,750 pounds.
- Engine, total—158,000 pounds.

Cylinders:
- H. P., 21 inches diameter, 28 inches stroke.
- Distance center to center—87 inches.



HEAVIEST PASSENGER LOCOMOTIVE EVER BUILT.

plenty to do on the grades which abound on certain parts of the line, and to make fast time on these hills is the object of the designer.

The valve gear is not handicapped with long, bent eccentric rods, neither are the rods abnormally short, the links having a radius of 53½ inches. The rocker is actuated by a return bar. Special attention has been given to securing the cylinders to the smokebox by double bolting through flanges of the saddles, the bolts passing through a ⅝-inch steel reinforcing plate at the smokebox. The same care has been taken to prevent loosening of the joints at steam and exhaust pipes. In fact, the details of the engines give

- Fuel—Bituminous coal.
- Number of drivers—6.
- Number of truck wheels—4.
- Simple.

Running gear:
- Driving wheels, diameter—72 inches.
- Truck wheels, diameter—36 inches (McKee-Fuller steel tired).
- Tender wheels, diameter—38 inches (McKee-Fuller steel tired).
- Engine truck—Swing center.
- Journals, driving axles—8½ x 11 inches.
- Journals, truck axles—5½ x 10 inches.
- Journals, tender axles—4¼ x 8 inches.

Wheel base:
- Driving—14 feet 7 inches.
- Truck—6 feet 9 inches.
- Distance center to valve face—17½ inches.
- Piston rod, diameter—3¾ inches.
- Steel crosshead—Railroad company's standard.
- Steel guides—Two-bar type.
- Connecting rod, length between centers—10 feet 4 inches.

Valve gear:
- Type—Shifting link motion.
- Ports—Length, 19 inches; width steam, 1⅜ inches; width exhaust, 3 inches.

Boiler:
- Type—Extended wagon top radial stayed.
- Diameter of barrel inside—60¾ inches.
- Thickness of barrel plates ⅝ inch.

Thickness of smokebox tube plate—½ inch.
Hight from rail to center line—8 feet 4¾ inches.
Length of smokebox—5 feet 8 3-16 inches.
Working steam pressure—200 pounds.

Firebox:
Type—Wide, with forged-down frame.
Length inside—10 feet.
Width inside—3 feet 5⅞ inches.
Depth at front—6 feet 3 inches.
Depth at back—5 feet ½ inch.
Thickness of side plates—⅜ inch.
Thickness of back plate—⅜ inch.
Thickness of crown sheet—⅜ inch.
Thickness of tube sheet—½ inch.
Grate area—34.9 square feet.
Staybolts—1⅛ inch diameter, 4¼ inch pitch.
Water space—Back and sides, 3¼ inches; front, 4 inches.

Tubes:
Material—Iron.
Number—295.
Diameter outside—2 inches; No. 12, B. W. G.
Length between tube plates—14 feet 4¼ inches.

Heating surface:
Tubes, exterior—2,217.16 square feet.
Firebox—192.96 square feet.
Total, with exterior tube area—2,410.12 square feet.

Miscellaneous:
Exhaust nozzle, diameter—5⅝ inches.
Smokestack, smallest diameter — 16 inches, straight.
Smokestack, hight from rail to top—15 feet 1¼ inches.
Capacity of tank—4,500 gallons.
Brake fittings—American Brake Company's outside equalized brake on drivers; Westinghouse Air Brake Company's brake on tender trucks.

Old Baltimore & Ohio Locomotives.

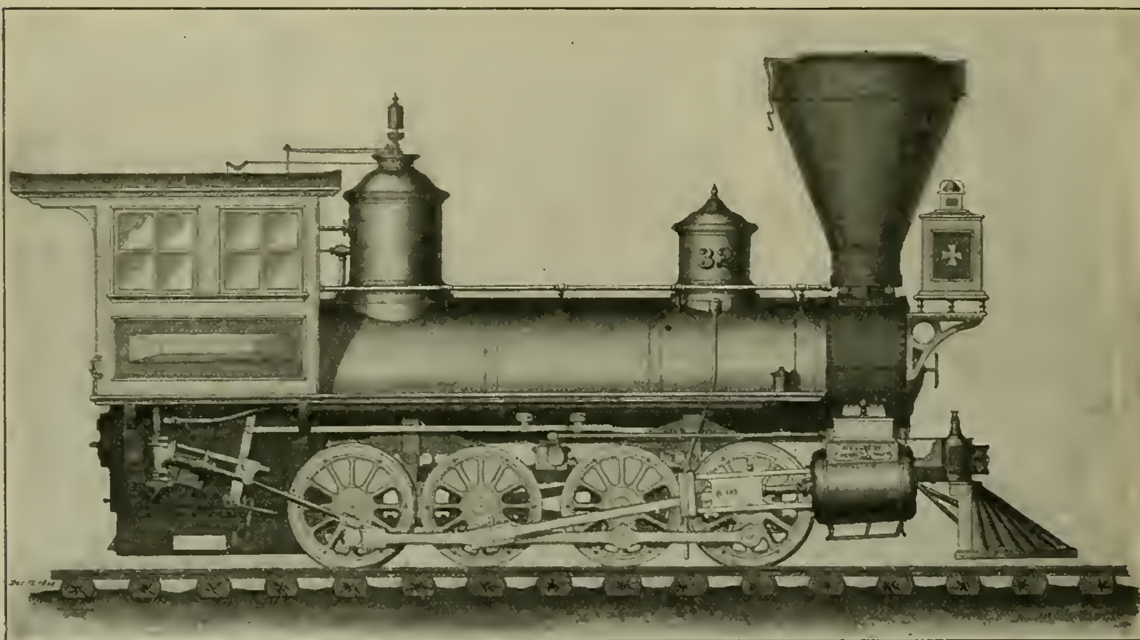
Through the kindness of Mr. J. Snowden Bell, the well-known patent attorney, of Pittsburg, Pa., who kindly loaned us the photographs from which the engravings were made, we show pictures of three old Baltimore & Ohio locomotives that form interesting links between the small earlier types and the heavy modern engines of to-day.

A letter from Mr. O. C. Cromwell, chief draftsman of the Baltimore & Ohio, gives some particulars about Nos. 32 and 117, but the identity of No. 238 appears to be lost. Mr. Bell says that the only particulars he has about the engines are that they were the first Baltimore & Ohio passenger engines with cylinders 17 x 24 inches, drivers 66 inches diameter and smallest ring of boiler 46⅝ inches. Five of these engines were built in 1865, and had stationary links.

All the engines were built in the early sixties, Nos. 32 and 238 having been designed by J. Perkins, master mechanic of the road. Mr. Cromwell writes:

"Engine 32—Crown sheet was supported by staybolts with nuts on under side. The frames were extraordinarily heavy, the top rail being 6 inches deep by 3¾ inches wide. The frames did not extend further back than the front of firebox, against which they abutted, being tied together at this point with a cross brace, which in turn supported the boiler with a bracket bolted against the throat sheet.

"Engine 117—The Perkins engines now have 19 x 26-inch cylinders, but this engine was probably built with different-sized cylinders, of which you probably have information. The drivers are now 60 inches; but I think you stated to me that they were originally 64½ inches. The crown sheet was supported by crown bars. We find an old drawing of this boiler with the combustion chamber with which she was first built."



OLD BALTIMORE & OHIO LOCOMOTIVES.

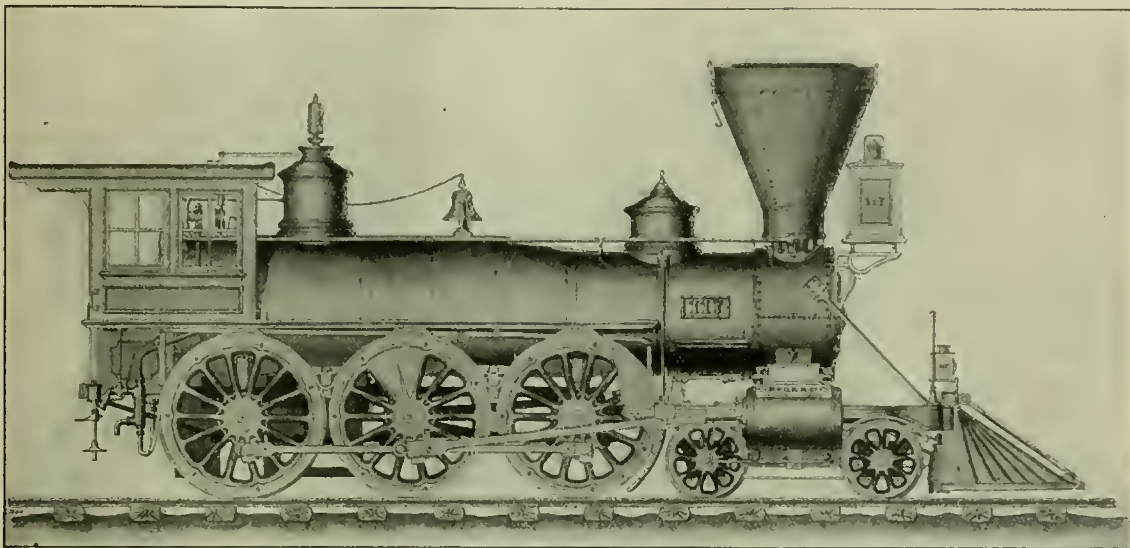
We are informed that the case of the St. Louis Car Coupler Company vs. the National Malleable Castings Company has been decided in the United States Circuit Court of Appeals for the northern district of Ohio, Judge Taft's decision being affirmed. The present opinion, rendered by Judge Lurton, reviews prior patents fully and holds the Lorrain and Aubin patents to be very narrow in scope and not infringed because the Tower coupler is not centrally pivoted and not U-shaped.

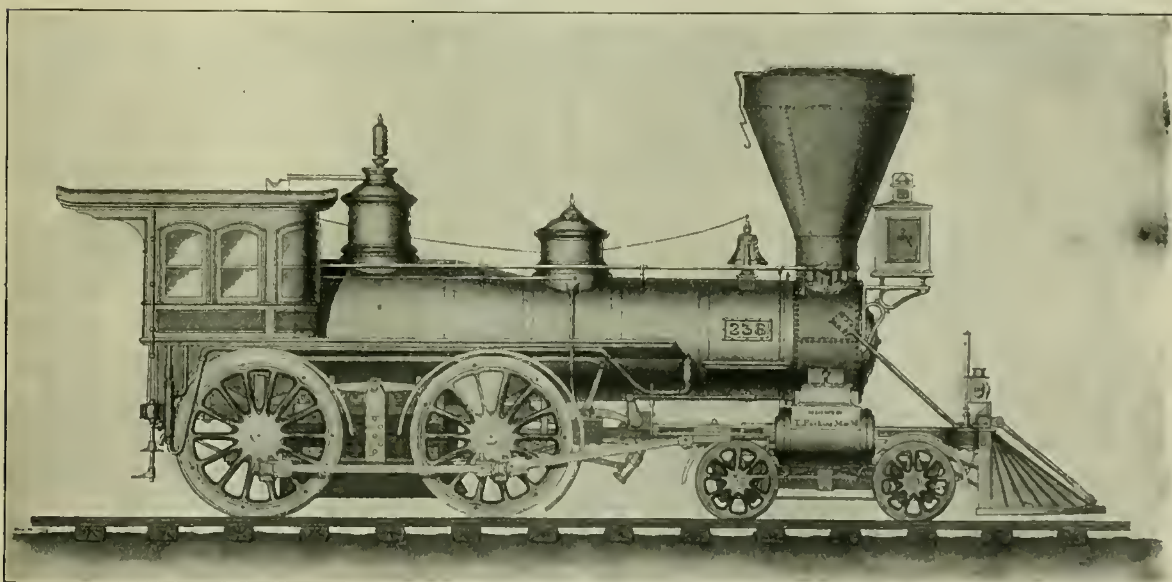
The National Association of Manufacturers of the United States, an organization of business men for business purposes, has issued a pamphlet setting forth what the association expects to do. Business men who are striving to extend their trade with foreign countries ought to send for this booklet. Address, 1743 North Fourth street, Philadelphia.

Some Kinks from the Erie Shops.

The production of patch bolts for boiler work is somewhat different, at these shops, from anything we have encountered elsewhere, and on the score of originality, as well as of quality of the job, will be described. These bolts are made in all sizes from ½ inch up to 1⅛ inches diameter, in a die used on a bolt heading machine. The correct amount of stock is cut off the bar to form one bolt, and the bolt header forces the metal into the die, forming the body, coned head and square for the wrench; the bolt is then kicked out of the die automatically by a punch, completed, and with a body of just the right length to pass through two sheets. The job is a remarkably smooth one, and the idea of cutting to neat length for the sheets is a good one, aside from the saving of material, for the reason that the bolts are no longer scale collectors.

The bolts are turned and threaded in a home-made machine consisting of a coned pulley and chuck—the latter holding the bolt by the squared end—and a die-head containing a die with four cutters that are used to remove the stock on the body and coned head. These dies have a long lease of life, for the reason that the forming dies are made so as to leave the smallest amount of work to be done to true the bolt—in fact, to merely scrape it. Opposite the turning die, but in the same head, is another die with screw chasers for threading the bolts. These cutting tools are placed equidistant from the center of the die-head, which revolves in a vertical plane and locks either die in position, in line with the bolt when ready for operation. The functions of the die-head are exactly the same as those of the so-called turret, with the difference of plane of revolution, as noted. A cutting-off tool for nicking the head at the square, constitutes, with the parts mentioned, the whole of a very cheap and efficient machine. The advantages of die work on these bolts are two-fold, in preventing waste of stock, first in the length and next in the diameter. This tool and the bolt





OLD BALTIMORE & OHIO LOCOMOTIVES.

header make all the patch bolts used on the system, and do it at the rate of 800 in the bolt header, and 1,000 in the finishing machine, per day of ten hours.

An inexpensive way to overhaul worn valve motion links for wear due to link block flanges, is practiced here. It is done by placing the link on the radial planer, as though to have the slot trued up—and which is trued at this setting if necessary to do so—and an emery wheel of a width suitable to the width of the link block flange is used on the worn surface. This, of course, reduces the thickness of the link at the point of wear of the flanges, and makes necessary a thinner block, but this loss develops a gain over reducing the total thickness of the link, because it saves closing in the eccentric jaws, and consequent change of shoulders on pins.

The lining of driving wheel hubs, as in vogue here, is not general practice, since these are put on in a solid ring, so as to be loose when in position. The hubs are counterbored, and the wheels are placed on end to have a mold built up on the hub, into which is poured brass to the required amount, making a liner about ¾-inch thick. Shrinkage on the smaller shoulder is provided against by placing several thicknesses of paper at that point before pouring. There is enough shrink left by this means to hold the liner solid against the cut of a tool in facing off, after which it can be loosened and left free to revolve. The liner thus has two frictional faces, instead of one, to take the wear between box and hub. This method of lining hubs is said to work beautifully by those who have practiced it. Facilities are needed, however, to do it full justice and get the best results; these they have at Susquehanna, in the air crane for handling the wheels, and also a large brass furnace, both of which are just outside of the machine shop and under cover. The crane is, however, an adjunct that could be illy spared, since it has shown its capacity in loading wheels and heavy scrap, in addition to the purposes for which it was put up.

The foreign demand for "The World's Rail Way" is remarkably active. Those who have purchased the book are highly pleased with it.

Fads and Fancies of Locomotive Building—No. 4.

"L'Aigle" is one of the early developments of the big-wheel idea—and is one which hasn't been altogether abandoned even yet, as too many think speed depends on the size of wheels rather than on power.

This was boxed in like a side-wheel steamer, and the boiler proper lay below the driving axles, there being several steam drums above in otherwise vacant spaces. The drivers were 9 feet 4 inches in diameter, while the cylinders were 16½ inches in diameter by 31½ inches stroke. It was exhibited in the Paris Exposition of 1855, having been built for the Western Railway of France.

New Dickson Eight-Wheeler.

The handsome eight-wheel locomotive shown in the annexed half-tone engraving bears eloquent testimony to the advances made within the last year by the builders, the Dickson Locomotive Works, of Scranton, Pa. The engine is one of an order given by the Buffalo, Rochester & Pittsburgh Railroad, and is intended for passenger service. The cylinders are 18 x 24 inches, drivers 68 inches diameter, and boiler 58 inches diameter at smallest ring. There are 256 2-inch tubes. The firebox is 96 x 42 inches, and provides 138.32 square feet of heating surface. The total heating surface is 1,784 square feet, and the grate area is 28 square feet. The working boiler pressure is 180 pounds. The weight in working order is 118,200 pounds, 77,300 pounds of that resting on the driving wheels.

NEW DICKSON EIGHT-WHEELER.

At the last convention of the Railway Master Mechanics' Association a very valuable report was submitted on "The proper ratio of heating surface and grate area to cylinder volume," in which rules were given for the proportions of a locomotive that would approximate to the most successful engines in service. This new Dickson locomotive, whether by design or accident, comes very closely to the rules laid down by the committee referred to, except in the size of steam and exhaust ports, an exception which proves the good sense of the designers. The following table gives a comparison of the leading ratios of what we consider the best form of bituminous-burning, eight-wheel passenger engine mentioned by the Master Mechanics' Committee (No. 23 in table G, Master Mechanics' Report) and those of the Dickson locomotive:

	M. M. Locomotive.	Dickson Locomotive.
Weight on drivers	79,000 lbs.	77,3c0 lbs.
Size of cylinders	18x24 ins.	18x24 ins.
Ratio of grate to cubic feet of cylinder volume	3 39	3.96
Ratio of grate area to area through tubes	6.19	5
Ratio of heating surface to cylinder volume	210	252.7
Ratio of heating surface to grate area	62	63.7
Ratio of firebox heating surface to total heating surface	10	12.9
Ratio of tractive force to adhesive weight	0.21	0.226

These particulars show that the Dickson locomotive has a margin of efficiency in all respects over what may be called the ideal engine described in the Master Mechanics' report.

More False Engineering Notes.

Our notes on this subject in the March issue called out the following from a personal correspondent:

"One day a cousin of mine was looking at a locomotive, and after wrestling in vain with the problem for a few minutes, he said:

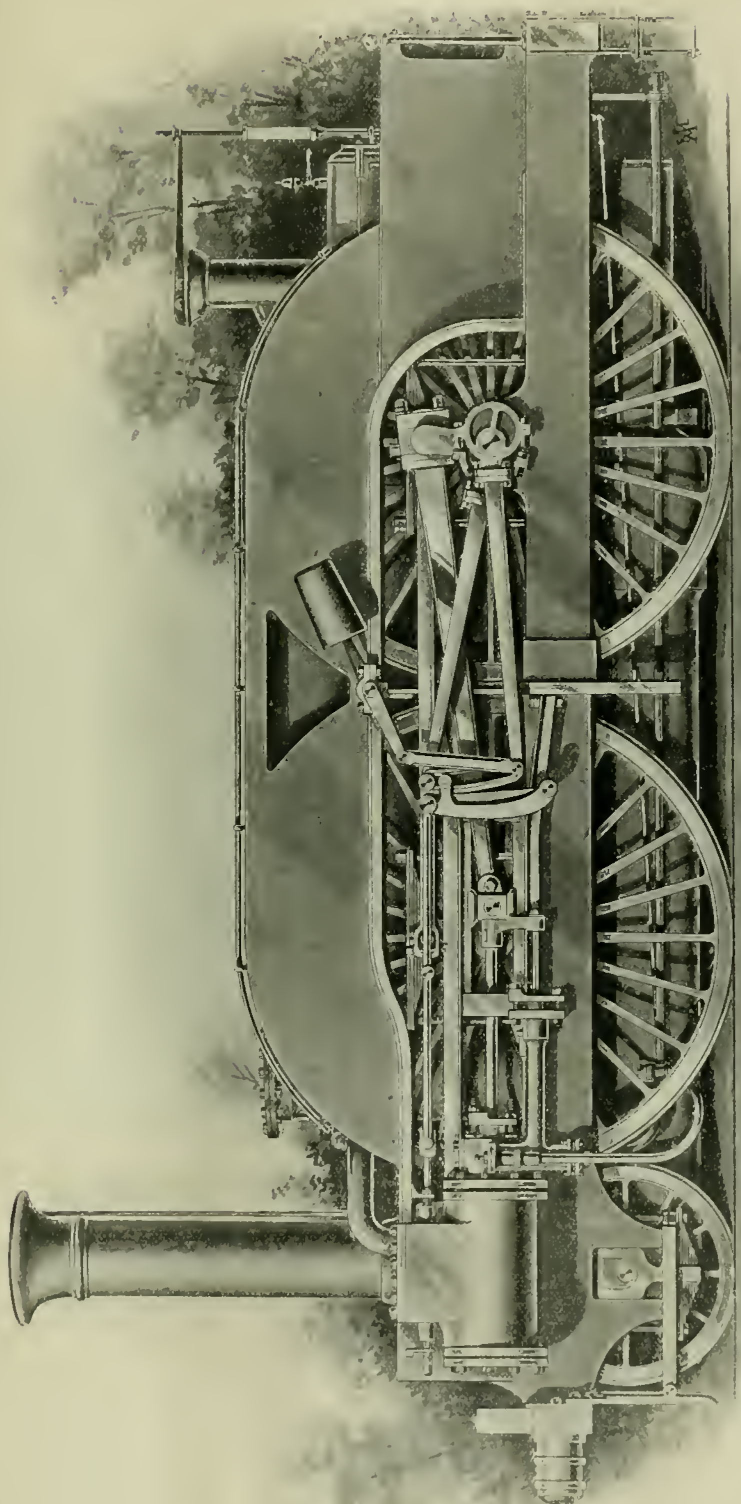
"'Well, I can understand how the engineer makes it go ahead, because when he pushes that little handle, he pushes the steam into the boiler; but I will be darned if I can understand how he makes it go backwards.'

"Another time I was walking up the track with the superintendent of one of the biggest machine shops in the world, and, passing a locomotive, I said:

"'Don't you think it is wonderful how one small man can control that big machine?'

"'No, I don't,' said the superintendent; 'he pulls the handle, and it has *got* to go, and that is all there is about it.'"

In our January issue mention was made of the first steam motor car on the Erie road, in which its career was traced to the end. The engines that propelled that car have not seen their finish, nor are they likely to for several years to come, for they are driving the transfer table in the Susquehanna shops, where they have been for years, and are still good for unlimited service of that kind.



FADS AND FANCIES IN LOCOMOTIVE BUILDING—No. 4.
"L'AIGLE," BY BLAVIER, OF FRANCE, 1855.

An Interesting Model Room

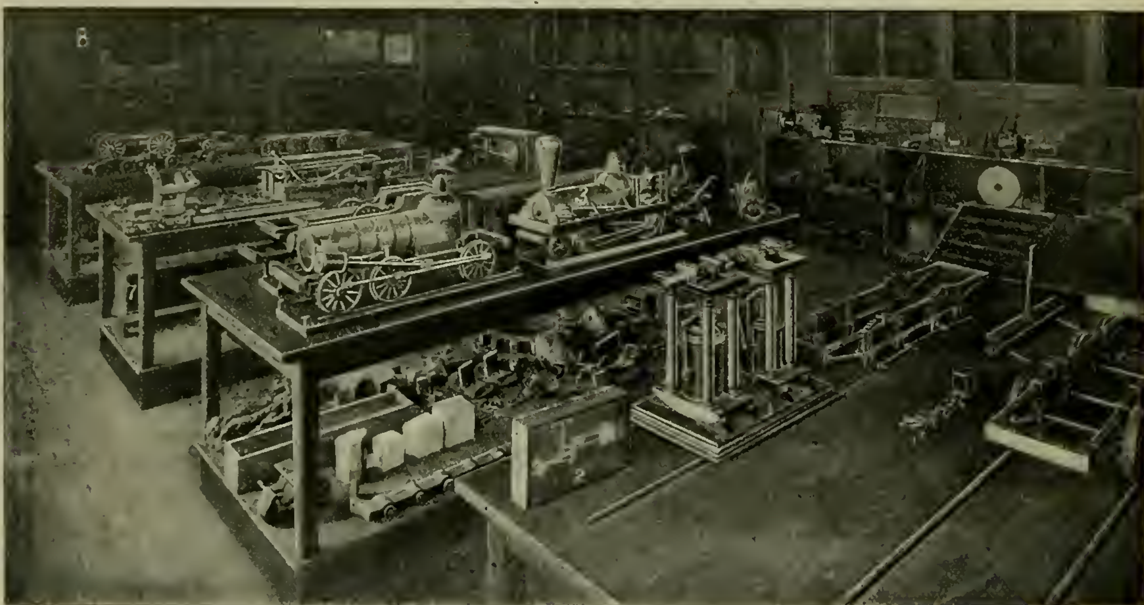
The model room of the Baldwin Locomotive Works contains many features of interest, a few of which are shown in the accompanying photograph. Those that are numbered are described as follows:

1. Model of an upright stationary engine designed by M. W. Baldwin prior to his engaging in the locomotive business.

2. Model of Stephenson's link and valve motion, with Camerer's cut-off.

3. Model of locomotive with geared connection to truck wheels, operated by crank and connecting rod from driving wheel.

4. Model of M. W. Baldwin's six-wheel connected locomotive with flexible truck.



MODEL ROOM OF BALDWIN LOCOMOTIVE WORKS.

5. Model of sleeping car built in 1842.

6. Model of rotary valve and steam-chest.

7. Tool chest cabinet used by M. W. Baldwin in his younger days.

8. Model of locomotive "Old Ironsides." This model which has the principal working parts formed of cardboard and mounted on a sectional drawing of a locomotive boiler, was used in the early '30's by Mr. Baldwin to explain the working of the locomotive engine.

Too Much Johnson Bar.

One night about eight years ago, a Vauclain compound might have been seen "fanning" a train of stock over the level ten-mile strip between Fargo and Glyndon, on the Northern Pacific. In fact she was seen, and the way it came about was this. The 587 was a mogul and the first compound engine on that road, and as a consequence she was subjected to the refining influences of indicators, calorimeters, vacuum gages, pyrometers, water meters, scales for weighing fuel and every device supposed to be manipulated by the expert when engaged in locomotive test work.

The engine had shown a remarkable performance in fuel saving in the trials with weighed tonnage, and was still engaged in smashing simple-engine records, when an order came from the superintendent to take the engine out of the test and bring eighteen loads of stock East. The engineer, who had by this time about touched bottom on compound economy at schedule speeds, was anxious to know what the engine could do when he let her go, and upon reading his order, he did not disguise the fact to the "expert" who stayed with the engine, that he would get 'em there, and the hustle he had on those stock cars on the level aforementioned was only preliminary to getting a run at Muskoda hill, an eight-mile pull on a series of nasty reverse curves.

While this is the longest continuous grade on the division, the total rise in 37 miles to Detroit is about 500 feet, with some stubby short climbs, and it was certain the engine would be worked simple a part of this distance. Detroit was reached about daylight, and the engineer, who was proud of a good run, turned to the man of figures and remarked, as he slipped down off his seat, "Say, we didn't do a t'ing to 'em, did we?" The empty coal space in the tank did not seem to corroborate this negative proposition, and the reason was apparent, for the starting valve lever used to admit steam to the low-pressure cylinder when working simple, was seen to be in the "corner," where it had been placed when the first grade resistance was felt, and forgotten.

This lever had been named the "Johnson bar" by the engineer, who, when he came to a full realization of the situation, had to make himself right, and said confidentially, "I niver tho't av that Johnson bar from the fut av the hill; don't say a word to the byes." The engine resumed the test work after that trip with the stock train, and the elegant record made before and after by the same engineer gave proof that the "Johnson bar" was not forgotten. We have often wondered since the occurrence recounted, if some bad reports of compound performance were not due to too much "Johnson bar."

Safe, But Behind Time.

Old Jake Schoenstimer was as cautious a man as ever yanked a reverse lever or whistled for brakes on the Delaware, Lackawanna & Western road. One night he was crawling up Pocono, and had got to one of the "knolls," when he suddenly reversed and said to his fireman, "Shimmy, my poy, dot looks like der red light oop dare." Jimmy didn't see any, and said so, and Jake finally pulled out again. Pretty soon, at another curve, he repeated the operation, and sang out, "Dere's dot red light again, Shimmy."

But it wasn't; 'twas just a glimpse at the moon occasionally, and Jake was laid out on time, as well as being well laughed at.

Rebuilding Consolidation Engines on the Erie.

Among the largest railroad repair shops on this continent is that at Susquehanna on the Erie Railroad. This claim for immensity of proportions refers especially to the machine and erecting shop, which is 770 feet long and 200 feet wide; figures that were considered a marvel at the time the shops were built, about forty years ago, and inspire a similar feeling even now. This plant is the headquarters for all new locomotive and car work done on the road, besides the usual routine of locomotive repair work.

The machine shop, built of stone, is divided into three spaces, running full length, the outer ones being occupied by the machine tools and transfer table, respectively; and the central panel, with its twenty-two tracks, is devoted to engine erecting, of which at this time there is every sign of activity, indicating the fact that power cannot be kept up without hospital treatment. The old consolidation engines with 20 x 24-inch cylinders, 54-inch boilers and 50-inch drivers, are being put through such a course, and will leave the hands of the doctors transformed into a power of the first class. To accomplish this, the old boilers with narrow fireboxes are replaced with new boilers 60 inches in diameter, having wide fireboxes of the Wootten type. The old boilers were designed for 150 pounds pressure, but are no longer safe to run with that pressure, therefore the new boilers, which are designed for 180 pounds pressure.

New cylinders, 19 x 24 inches, are applied, for two reasons—first, because the old are worn to the limit (1 inch large in some cases), and second, because the old saddles are too low for the new boilers. All other parts of the old engines are used in the rejuvenating process—wheels, axles, motion work and frames; the latter, however, are lengthened at the back of the rear jaw in order to get the wide firebox back as far as possible. There are several advantages resulting from this reduction of cylinder diameter and increase of boiler capacity that make these rebuilt engines representative of the most careful thought in engine design, the figures chosen by Superintendent of Motive Power Mitchell showing a harmonious arrangement in their relation to each other—such as giving an increased heating surface and steam reserve, and at the same time, by reason of the added weight on the wheels, the tractive effort is not too near the slipping point. There are fifteen of these engines now rebuilt and doing excellent work. The rebuilt moguls which have 68-inch wheels and carry 180 pounds boiler pressure, are designed for either freight or passenger service, and show up admirably in any work assigned them.

Prospects of Electrical Operation of Surface Railroads.

Amidst the conflicting statements and opinions expressed by railroad men and electricians concerning the progress of electrical transmission on surface railroads, it is refreshing to read the following lucid views on the subject, as expressed by Mr. Lucius Tuttle, president of the Boston & Maine Railroad, and one of the clearest-headed railroad men in the country:

"I do not regard the third-rail system as beyond an experimental stage in any part of the country. The Nantasket Railroad, operated by the Consolidated, is to be regarded as still an experiment, and so is the third-rail line from Hartford to New Britain. These seem to operate successfully, as far as they go, but they do not meet the problems of the main lines of railroad where there is a large amount of local and express passenger travel and of freight transportation. Thus far the third rail has operated light trains running for comparatively short distances. If the solution of the problem could be reached by breaking up the present local passenger trains into single car service, with such motor power as is now available, it could be solved easily. But to do it, under the present system of operating railroads, would require the construction of a new track for that particular business. As it is now, a local passenger train may be

GENERAL OFFICE, BALDWIN LOCOMOTIVE WORKS.

followed in a short time by an express, as soon as the passenger is out of the way. After the express may come a long freight train. Both the express and the freight require far more power than can be given by any motors now in use. Electric transportation requires the breaking up of local trains into such small parts as will interfere with the freight and express passenger. The problem is not only the division of the power now used for local passenger trains into sufficiently small portions for the frequent running of single cars, but there must be secured also, if the same tracks are to be used, sufficient power for the large trains. This step has not been taken yet, and hence, in a broad way, it is perfectly true that the system of electric transportation, as applied to the steam roads, is yet in an experimental stage."

Sending the President a Present

"We were all young engineers and firemen then," said an old-time engineer, in speaking about an incident of war times on the road, "and a little hot-headed about some things, but we were mad clear through when the company sent a plain pine coffin for Jack Barker to be buried in, after he had been crushed and scalded under one of their old death-traps, which they were running because they were short of engines.

"Jack had been a good runner, and had worked faithfully through thick and thin, and we thought he deserved a better resting place than an old pine box, so we got him one.

"Got the best we could find in all of Wilkesbarre, too—mahogany, nickel handles and all. Then we were wondering what to do with the other one, and some dare-devil of a youngster suggested sending it to the president of the road, with our compliments. Well, before we realized it, we had voted to do it, and off it went.

"I never knew how it was received; but the company never sent any more pine boxes when an engineer or fireman was killed."

Mr. Frederick A. Delano, superintendent of the Chicago terminals of the C., B. & Q. Railway Company, gave the tenth lecture in the series of addresses on railway subjects before the engineering students of Purdue University, on March 9th. His subject was "Railway Signaling." After carefully classifying such signals according to their form and the purpose for which they are employed, Mr. Delano confined his attention to a discussion of the fundamental principles affecting the operation and interpretation of fixed signals. He traced the historical development of the signal idea, discussed the larger and more general questions involved, and disclosed the tendencies of present practice. The lecture was illustrated by means of models and diagrams, which will be given in connection with the text as finally published by the university.

PRIVATE OFFICE, BALDWIN LOCOMOTIVE WORKS.

Contrast in Modern Locomotives.

The immense twelve-wheel Great Northern locomotive and the Korea tank locomotive, both among the latest output of the Brooks Locomotive Works, shown on this page, represent a great contrast in locomotive construction.

The Great Northern locomotive was fully described in the January issue of LOCOMOTIVE ENGINEERING. She has cylinders 21 x 34.

Last year an American firm secured from the Royal Government a concession to build a railroad in Korea, the first and only one in that country, and notwithstanding constant political disturbances, its construction and equipment have gone steadily forward. This railroad is of the American standard gage, and is known as the Seoul-Chemulpo Railway, extending from Seoul, the capital of Korea, on the north to Chemulpo, the chief seaport on the south, a distance of about twenty-five miles.

An order was recently given to the Brooks Locomotive Works to build four locomotives for this company, the locomotive shown being one of the order. It is expected that the railway will be entirely equipped with engines of this character. The cylinders are 14 x 22 inches; drivers, 42 inches diameter. The boiler is straight 46 inches diameter, and the firebox is 54 inches long and 35 inches wide. There are 122 charcoal iron tubes used, 2 inches in diameter. The tank has a capacity of 800 imperial gallons. The engine, weighs in working order, 78,600 pounds, 67,600 of that being on the drivers.

Welding Copper.

Ever since we mentioned, in December, that Messrs. Wyman & Gordon, of Worcester, had developed a process for welding copper, we have had inquiries as to how it was done, showing that the paper is read in the shops as well as on the road.

One of our subscribers, Mr. Harry J. White, of Beaumont, Texas, sends us his way of welding copper to copper or copper to steel. He writes that it is not difficult, and can be done successfully after a little practice. We give his own description of the process:

"I use a charcoal or coke fire (as coal with any sulphur in it is detrimental) in a blacksmith forge, using pulverized borax, powdered glass or pure white sand for a flux. The main thing is to keep the metal completely covered with flux all during the heat, never allowing it to burn off even when ready to take from fire. For welding pipe or union rings on branch pipes, I put any old casting over fire, with hole in it, and heat pipe over that, as it gives me a better chance to watch heat on light work. I have a 4-pound soft hammer made from an old branch pipe, that has been in use four years, and not split. On work heavy as that I use sand or glass, whichever is convenient, always working the heat off with light blows, and striking so as to upset the piece. I use about the same heat as to weld cast steel. I find that copper and steel weld easier than copper and iron, as they are both metals that require a flux. I first found it could be done by trying to harden copper, but have not succeeded in this yet."

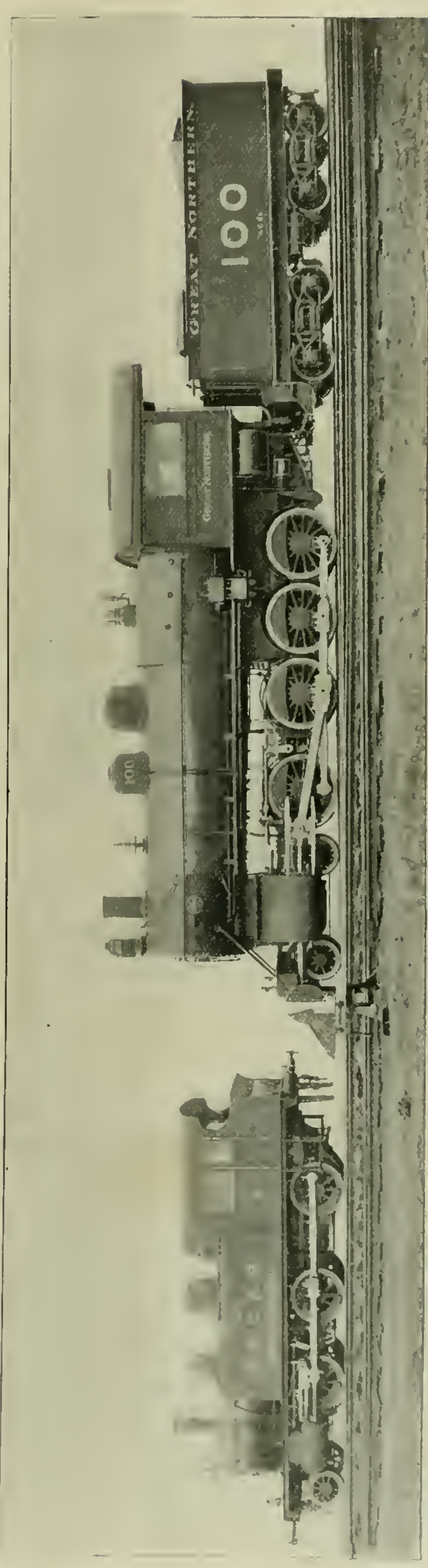
A Queer Steam Dome.

The writer recently attended a jubilee meeting of a well-known society, in which the simile was drawn between the society and a locomotive by each member having a piece of paper, cut like some part of the engine, and speaking a little piece describing that part of the society. Similes are a wise thing, but it's better to become acquainted with the article in question, so as to get things straight.

The leader described the locomotive as being made of iron, coal and water. Then driving wheels were placed so the back pair would scrape the tank and wouldn't carry any weight. Then the whistle was put on, and although it was top of the dome, no mention was made of the latter; they evidently thought it was all whistle. Finally, the steam dome was announced, and to the amazement of all railroaders present, the sandbox was carried triumphantly to its place, while the importance of the dome was dilated on by the speaker.

Don't simile till you know how your example is made and what it does.

If you are raising a club, do not wait till the list is complete, before sending in names. Send them in as you receive them. If you wait long, there is danger that your subscribers cannot obtain numbers for the whole year.



LATEST BROOKS LOCOMOTIVES.

Practical Letters from Practical Men.

All letters in this Department must have name of author attached.

Acetylene Gas for Car Lighting.

Editors:

Again referring to the matter of car lighting with acetylene gas on the Pontiac-Pacific Junction Railroad: Some months ago, in conversation with the local agents, Messrs. Holland Bros., of Ottawa, Ont., for the Niagara Falls acetylene gas generator, I suggested that acetylene gas would be a splendid lighting element for the railway cars, if it could be utilized without danger. Mr. Andrew Holland, one of the proprietors, asserted positively that he could light the cars safely and brilliantly with one of the generators used for house lighting. The problems to be met were:

1st. The effect of intense frost on the gas machine and on the gas when piped between cars with rubber hose, and when the train was running thirty or forty miles per hour with the mercury away below zero.

2d. The effect of vibration of cars on rough track on the steadiness of light.

3d. The danger of gas escaping from generator by the agitation of the water in the gas tank.

4th. The slopping over of water from the gas tank on the floor of car, and in consequence, smell of escaping gas.

Shortly after this conversation I placed the train at Messrs. Holland Bros.' disposal for equipment. A twenty-light generator was installed in the baggage car. The cars were temporarily piped for gas fixtures, and the first trial decided that three of the expected difficulties amounted to nothing in actual work—the tank and the gas were not affected by the frost; the lights were not affected by the vibration of the cars, and the illumination was more brilliant than on any train I have ever seen. I believe it to be the most brilliant light used to-day on any train in the United States or Canada.

On through mixed express, as we run on this line, with all the drawbacks of shunting, etc., causing slopping over from water tank, etc., during our first experiments, the light is so far ahead of anything that we have yet seen in economy and convenience, we will never revert to oil system of lighting again. But where a train has to be broken occasionally and cars shunted, it can readily be seen that such a system could not be worked. Here, again, Messrs. Holland Bros. came to our assistance, and has installed a plant for us in each of our coaches that requires less carbide and avoids slopping, smell from gas and positively safe, because the gas is only generated in such small quantities under low pressure that the amount generated at any one time, if such a thing could be, an explosion would not break a pane of glass. If the cars were to turn over, the lights would go out, and the gas would simply pass away harmlessly into the air, as no fire could possibly result from it. The plant is installed in the toilet department; it occupies a floor space of about 14 x 26 inches. These generators have a capacity for the lighting of six lights of fifty candle-power each. The charges in attendance of these generators are so simple that an ordinary chore boy attends to ours without any difficulty or danger. We propose to equip all our cars with the acetylene gas plant, as being the cheapest, safest and most brilliant illuminant for railways yet discovered.

The carbide we use is manufactured by the Wilson Carbide Company, of St. Catherines, Ont. It costs $60 per ton f. o. b. at the factory, and the lighting of one of our coaches with this light enables the passengers to read their evening papers from any seat in the car, and costs but 25 cents for a six hours' run.

P. W. Resseman,
Gen'l Sup't.

Ottawa, Ont.

Where Locomotives Ran Without Valve Oil.

Editors:

The writer would be very much pleased if you can enlighten him by giving the name of the road owning 100 locomotives that you ran and fired on for seven years without using any valve oil upon any of those 100 locomotives. The writer presumes, of course, as long as there was no valve oil used, it must have been the wind that came from this noted engineer and fireman, who is now editor of the Locomotive Engineering, and who comments upon the record made on the Houston & Texas Central Railway, that did the lubricating of the valves and cylinders of these 100 locomotives. Of course, in that case no doubt each engine would have similar record, as the wind would be equally divided among them.

The writer happens to know something about what valve oil is doing on the Houston & Texas Central Railway, not only on engine 135, but all their engines, and while that engine made a remarkable record, and all of their engines are making remarkable records, they do not go into the shop, as your comments would have your readers believe, with valves and cylinders looking like a bird's-eye map of the Rocky Mountains. The cost of repairs on the Houston & Texas Central Railway is lower than nine-tenths of the roads in the United States that are using 50 per cent. more valve oil. The coal consumption is also as economical as any road, considering the price this company pays for coal in Texas. But as this is a little off the subject, we hope you will be able to give us the name of the road you lubricated their valves and cylinders with wind for seven years.

Galena Oil Company,
Per J. S. Patterson,
Resident Manager.

[The particular railway referred to was the Scottish North Eastern. If our correspondent had been a little less ignorant than he is of railroad history, he would have been aware that nearly all locomotives in the first few years after railroads were first introduced were operated without the use of valve oil. It will no doubt be news to our correspondent to learn that the damp steam common to low pressure acts as an indifferent lubricant. The plan of running valves and pistons without lubricants was, however, found expensive in other directions, and was gradually abandoned.

Locomotive Engineering has always been a steady and consistent advocate of economy in the use of oil, and has no doubt exerted considerable influence on the side of oil saving. It is, however, easy to carry saving of oil too far, and we believe that many railroad officers are doing this, and that their policy is very expensive by increasing repairs and friction, which cause waste of fuel.—Ed.]

Advantage of Copper Fireboxes and Brass Tubes.

Editors:

I have seen in your columns a great many letters and articles on the saving of fuel by careful manipulation of the various parts of a locomotive by the engineer and fireman, but I have never, as yet, seen any letter on the use of copper fireboxes and brass tubes on American locomotives. I don't believe that there is anyone who denies that copper fireboxes and brass tubes are more economical in coal than steel and iron, and the only objection to them that I can see is their greater first cost; but that would soon be more than made up in the cost of coal.

It is well known that English engines are more saving of coal than ours are;

and what is this due to, if not to their copper fireboxes and brass tubes?

If there is any good reason, except first cost, for not using the better conducting metal, I would certainly like to hear it.

EDMUND J. D. COXE.
Drifton, Pa.

[Copper fireboxes and brass tubes have been used sufficiently in American locomotives to demonstrate that the superior conductivity of these metals over iron and steel is not perceptible in practice. Careful tests showed a slight difference in favor of copper and brass when the surfaces were clean, but after they both got coated over with a little scale there was no difference.

A serious objection to copper fireboxes in this country was that the sparks wore the sheets thin very rapidly.—Ed.]

Canadian Pacific Regulator (Throttle) Valves.

Editors:

In your issue of February, 1898, I notice that Mr. R. Atkinson, of the Canadian Pacific Railway, is given credit for doing something to prevent regulator (throttle) valves from leaking, by coring them as shown in engraving, and in commenting on what was done, it states "a simple way to remove a serious element of danger, and the wonder of it is that these valves should be used for so many years before anyone could think of a remedy for the trouble." Mr. Atkinson's design is similar to the regulator valve as used on many of the L. & N. W. Railway (England) engines for the past twenty years. In this valve, steam passed down the inside and under bottom seat into dry pipe at the same time that it went in at the top. These valves were easy to handle, and very seldom leaked after once being ground in properly. Mr. Webb introduced a new throttle valve on his 5-foot 6-inch and 6-foot 6-inch single-expansion engines, which was situated in smokebox; but as it did not work very satisfactorily, he did not put it in the compounds, the old-style valve being used.

H. T. BENTLEY.
Belle Plains, Ia.

"He Got Them All."

Editors:

The following incident occurred some years ago in the repair shops of the Intercolonial Railway, at Moncton, N. B., and is illustrative of the kind of blunders that a beginner is apt to make in his anxiety to please. Jimmy had just entered the employ, and being very desirous of eventually rising to the top of the tree, lost no opportunity of displaying his willingness to work hard and steadily. His motto was, "Better do too much than too little," and he stuck to it as far as was possible in a government concern. One day he was told off to assist in the erecting of some shafting in the smithy, and though his duties were chiefly confined to carrying and passing tools, he kept his motto well in mind, and did his level best.

Old Homer, who had charge of the job, had a reputation of being rather short tempered, and so Jimmy, in his timid freshness, was doubly anxious to do well, and stood by with bated breath waiting for orders. When Homer needed a wrench, Jimmy fairly flew back to the erecting shop and returned in a remarkably short time with the required implement. The tool cupboard contained a great number of spanners and wrenches, but, as luck would have it, he found the object of his search almost immediately. Homer, on taking the tool, growled out, "Go get the maul," and poor Jim again departed, leaping over truck wheels and engine pits in his haste. This trip he was longer away, but his tardiness was easily explained, when he at last came in sight laboriously trundling a wheel-barrow full of spanners and wrenches, and his face beaming with the consciousness of having done his duty. He had mistaken "Get the maul" for "Get them all," and had consequently cleaned out the cupboard. Old Homer's remarks on seeing him need not be recorded here, but let it suffice when I say that they were more forcible than polite. Jimmy now occupies a good position on the above mentioned road, but even yet hears "Get them all" as he passes through the shops.

H. A. BAYFIELD, B. A. SC.
Moncton, N. B.

Favors Expert Fuel Inspectors.

Editors:

In your February issue, Mr. L. D. Shaffner brought up the subject of "saving oil and wasting coal;" and he suggests that we air our opinions in LOCOMOTIVE ENGINEERING columns.

I have a decided opinion, which is—that Mr. S. is on the right side, if it is the darkest looking at present; dark for two reasons—one is that its natural color is dark; the other is, that it is kept in the dark by the well-paid and ever-persistent opponents to its welfare. I would not pose as a philanthropist trying to inaugurate a new system, just because I feel it my duty. What I want is more holidays, shorter hours and more time to go fishing, and if my employer is making money and saving a portion of his earnings, he will be prosperous; and as I am dependent on him, I may, in a slight degree, be allowed to share in his prosperity. If the employés of a railroad company, through their united efforts, were able to save 20 per cent. of fuel (not an impossibility), the companies might add that to their wages (not a probability), but safe to say they would not cut existing wages, at least.

This is an old and well-worn subject. But someone once said that eternal vigilance was the price of liberty; it is equally true that eternal agitation of the fuel question would reduce the cost of operating a railroad.

I said this question was old. It was old when most of those who are concerned by it were railroading in the nursery and living on a milk diet. It has been kept boiling and simmering; at times nearly cold, again agitated until it boiled over; but the many ingredients have never been reduced to the consistency that they might be cut up in cakes and passed around to those who would eagerly devour them.

There are railroads in England, France and Germany where a man's ability as an engineer is gaged by his standing on the performance sheet as an economical user of valve oil, and each month, if his showing is good, he gets a letter of commendation; while a fellow engineer has been known to run the same number of miles, with all other conditions alike, and save 50 tons of coal, and he was not thanked for it—at least, not in writing. Why was it? The coal saved by the one would have bought all the oil used on the division.

But on the oil question we have a lot of paid agitators, expert agitators, those whose especial business it is to agitate that especial subject, and the least we could say is that it is well agitated.

These agitators are all right; several of them I am personally acquainted with, and beg their pardon for this intrusion into their business, and hope it will not cause their feelings to become unduly agitated, for there is only one defect in their construction—their reciprocating parts are not properly balanced, and although they are not a railroad appurtenance, I believe it would be well for the railroad companies to add the counterbalance in the shape of a fuel expert; for when two experts meet, they fight, and after all conflicts we have the survival of the fittest, and the companies would be gainers by at least the admission fee paid to see the fight.

It takes a diamond to cut a diamond, and in this case the white diamond would not escape a scratching. It is a fact that cannot be disputed, that we are saving oil at the expense of a dearer article, fuel, all over the country. During the past month I bushed a pair of cylinders which had been cut by an insufficient amount of oil. It cost $40, and that would have purchased several pints of oil; besides, they wasted fuel while cutting.

Mr. Herr, while on the Northwestern, showed by indicator that an engine lost 17 pounds from a M. E. P. of 73 pounds, due to lack of oil; this would soon buy a lot of oil, if allowed to continue. So, as Mr. S. said, examples might be multiplied, if necessary.

The oil companies have experts. The railroad companies need fuel experts. The answer will be like the answer given by diplomats in international controversies, "There is no precedent"; he would be a high-salaried nuisance. We have general managers, master mechanics, roundhouse foremen and traveling engineers to look after that and all other matters pertaining to the running of the road. But experts are what are needed to make anything a success. It has truly been said that a jack of all trades is master of none; so while our master mechanics and traveling engineers would be good timber to construct an expert of, they are not now fuel experts in the broadest sense of the word, simply because they cannot give it their undivided attention. The fuel expert (when he comes) should devote his time and best energies to the one subject, to the exclusion of all others. He should be able to tell at a glance whether a front end was properly arranged. He should test the engines in service with indicators on cylinders and vacuum gages on smokebox; should personally inspect grates and dampers, stacks and nozzles, front end and firebox doors; ride on the engines to see that the engineers and firemen are doing their whole duty; should have an ever-ready lecture on combustion; should have a tablet and pencil to figure out the cost of an engine "popping," or any other bad practice, in dollars and cents for a single instance, then multiply it by the days in the year and the number of engines the company owns—a sort of "Skeevers" object-lesson.

Mr. Shaffner suggests looking after the air-pump exhaust. I would suggest taking it out of the front end altogether and make it do useful work, such as heating the feed water when running and lubricating the cylinders while drifting down hill; the oil man will not object to that.

Furthermore, he should examine all patent appliances for saving fuel, for some of them possess merit; he should analyze the performance sheet monthly, which would in a great measure serve to direct him in his work; he should examine valves and cylinders to see that they were receiving sufficient oil; he should have a chemical analysis made of coal of all kinds, also experiment with different grades on the engines, then make a permanent selection; educate the men in the burning of that particular kind of coal.

Mr. Amann, in an article before the Northwestern Railway Club, once said: "An engine once arranged to burn a certain kind of coal, will not burn a different kind equally as well, be it a better or poorer quality;" so I would say, in short, that the fuel expert should be a genuine single-idea crank, with but one object, one aim—the reduction of the fuel bills. I honor a genuine crank. All illustrious men were cranks or demagogues and it is true as said, there is but 25 years between a demagogue and a demi-god. The same difference exists between a crank and the man that was able to see farther than his nose and was able by persistent efforts to abolish a time-worn practice or prove fallacious an accepted theory. It was a combination of cranks that founded the Christian religion, that started the rebellion that abolished slavery, and nothing short of a crank is able to push a single object to a successful issue. The fuel expert is coming just as sure as that there will be an end of time. When he comes he will be a spoke in the main driver. I am so sincere in my belief that such a man could effect a saving, that I would be willing to sign a three years' contract with any company in the United States to work for one-third the saving I could show by the blueprint. Who will be ze nex'?

D. P. KELLOGG,

Asst. Gen. F'man, D. & I. R. R. R.

Two Harbors, Mich.

Taking Off New York Triple Valves.

Editors:

There is a statement in your issue for February which is incorrect. You state that the B., R. & P. must remove all New York brakes from its cars, when in fact the B., R. & P. is simply taking off a few old triple valves and replacing them with the New York's latest type of valve.

I have since learned the said old triple valves were in litigation some years ago, and that they are now being taken off as a result of that litigation.

I have always considered LOCOMOTIVE ENGINEERING an excellent authority, but in the above instance it is either grossly in error, or guilty of trying to injure one of our leading manufacturing concerns.

F. C. WASHBURN.

Rochester, N. Y.

I noticed an article in your last issue relative to the removal of New York air brakes from the B., R. & P. R. R. I believe your article did not state the case in a fair manner, and as I am a lover of fairplay, I wish to take exceptions. You should have said that all equipment removed had been replaced by the new quick-action valve manufactured by the New York Air-Brake Company, which is just a little quicker than the Westinghouse triple. While I am not interested in either company, only as a laborer; but like to see matters stated as they exist.

FRED. K. COOPER.

Watertown, N. Y.

[In regard to the above letters, we have before us a printed decree of the Circuit Court of the United States, dated January 4th, regarding the removal of infringing New York air brakes from the cars of the Buffalo, Rochester & Pittsburgh. One part of the decree reads:

"The defendants (the Buffalo, Rochester & Pittsburgh Railroad Company) shall remove at least 250 of the infringed apparatus referred to in the moving papers within thirty days from this date, and at least 250 more of such apparatus within sixty days from date, and at least 250 more of such apparatus within ninety days from date, and the balance of all such apparatus within 120 days from date." This would lead us to believe that the news item which moved our correspondents to writing was quite correct.—Ed.]

Some New Old Things.

Editors:

I was interested in the new throttle valve and crosshead pin in your February number, and might have been more so if I hadn't used both of them way back in 1870 in the now defunct Rhode Island works. We used them both there, and unless I am very much mistaken, we sent ten moguls to the Grand Trunk road in 1874, which had the very crosshead pin illustrated.

The object in designing this crosshead was not to cheapen renewal, but to get a means of keeping them tight in the crosshead, as there had been trouble from the old pins getting loose. I don't see where the economy comes in, as it must cost about as much to fit up a bush as to make a new pin.

The only difference in the throttle is that the hole is larger than in the old ones. I don't exactly understand how the reducing valve is held shut by the intercepting valve in the Pittsburg compound. Don't see what difference it makes whether it is shut or open when working compound, as it "cuts no ice" then.

A. KNOX.

Easton, Pa.

Master Car Builder McBeth, of the New York Central, has great pains taken with journal bearings, both in the boring and lining of same; providing the best facilities for boring, which is done in vertical boring machines in good solid chucks that will hold the pair of brasses in line against any advance of the tool. That is more than can be said of the average device for holding a brass while boring. The most of them appear to have been evolved in the days of light cuts and buckskin feeds. It is folly of the highest rank to use a journal bearing from one of these wobblers, but it is done, and everybody knows the result. Good work on brasses and journals means good work on the road.

The difficulties attending renewal of the conical seats on reducing valves of the Canadian Pacific compounds, led Mechanical Superintendent Atkinson to bore out the chamber large enough to introduce a bushing on which the seat was formed. This idea has been found to work well, since a faulty seat may be easily repaired by pulling out the old bush and pressing in a new one with a true seat.

Baldwin Two-Cylinder Compound.

The annexed engraving shows by half-tone cut a perspective view of a two-cylinder compound locomotive recently built for the Norfolk & Western by the Baldwin Locomotive Works, and also a view of the low-pressure cylinder, with two boys sitting inside, which gives a graphic idea of its size. The principal dimensions of the engine are:

Cylinders—High pressure, 23 inches; low pressure, 35 inches; stroke, 32 inches.

Valve—Balanced.

Boiler, diameter at smallest ring—68 inches.

Thickness of sheets—11-16 and ¾ inch.

Working pressure—200 pounds.

Fuel—Soft coal.

Firebox, length—121 inches.

Firebox, width—41¾ inches.

Firebox, depth—Front, 74 inches; back, 72 inches.

Thickness of sheets—Sides, ⅜ inch; back, ½ inch; crown, ⅜ inch; tubes, ½ inch.

Tubes, number—306.

Tubes, diameter—2¼ inches.

Tubes, length—14 feet 6 inches.

Heating surface, firebox—195 square feet.

Heating surface, tubes—2,593.96 square feet.

Heating surface, total—2,788.96 square feet.

Grate area—34.8 square feet.

Driving wheels, O. S., diameter—56 inches.

Driving journals—8½ x 10½ inches.

Engine truck axle journals—6 x 10.

Weight on drivers—About 155,000 pounds.

Weight on truck—About 20,000 pounds.

Weight, total engine—About 175,000 pounds.

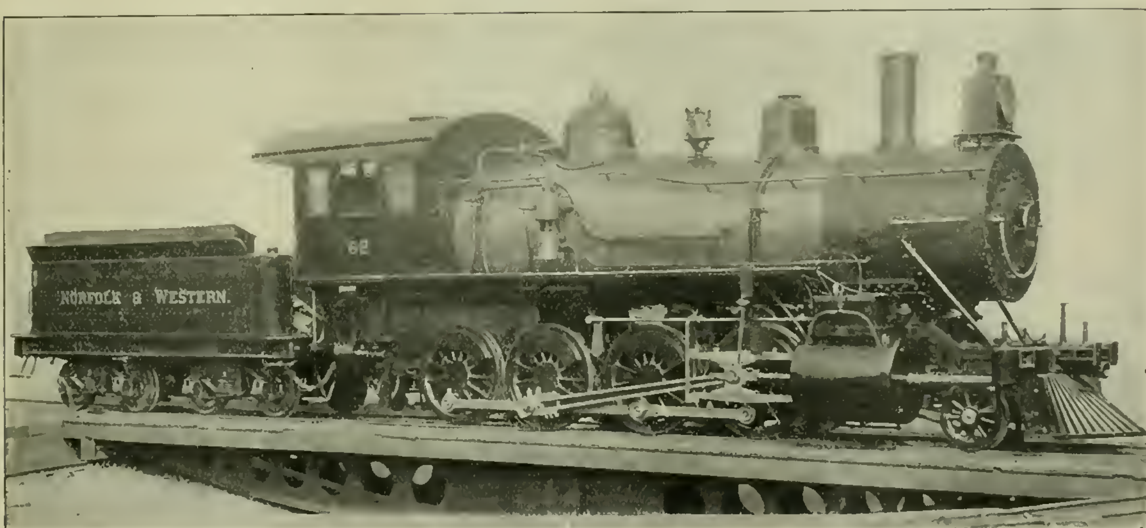
Wheel base, driving—15 feet 6 inches.

Wheel base, total engine—24 feet 6 inches.

Wheel base, total engine and tender—51 feet 8 inches.

We have much pleasure in noticing that a general increase in the wages of passenger trainmen behind the engine has been made by the Lehigh Valley. Conductors have been advanced from $2.75 to $3.25 a day; baggagemen and flagmen have been advanced to $2.30 and $1.90 a day, respectively. We trust that the company will soon be in a position to warm the hearts of the remaining employés by increasing their monthly checks or weight of currency.

LOW PRESSURE CYLINDER, BALDWIN TWO-CYLINDER COMPOUND.



BALDWIN TWO CYLINDER COMPOUND.

Fitting Pedestal Binders and Setting Frames.

BY IRA A. MOORE

When the back frames have been taken down to allow extensive boiler repairs, or for other reasons, it is important that when they be put in place again, that they be properly lined and squared up. In what follows we will endeavor to show how this can be accomplished.

The last operation, when taking the frames down, should be to put them bottom side up on blocks at least 1 foot high. This will leave them in a convenient position for fitting the pedestal binders, which we will proceed to do at once.

We will suppose that new pedestal binders are necessary, and the first thing to be done in fitting them is to prepare the frame, or bottom ends of pedestal jaws, for receiving them.

The fit *a a'*, *b b'*, Fig. 1, should be filed perfectly at right angles to the frame's length, and all to the same bevel, which should be about 7 degrees from a right angle to the top of frame. *b'* and *a'* should be ⅛ inch below the face of pedestal jaw, as shown in Fig. 1, to allow the jaws to be refaced without destroying the fit. Before the pedestal binder is laid out it should be planed on one side.

Now bolt two straps of iron, about 8 x 1½ x ⅛ inch (*c c'*, Fig. 1), to the frame, as shown, and let them extend at right angles to the frame. Lay the binder on these strips, planed side down, and against the side of the pedestal jaw, being careful to have the ends extend the same distance back and front of the fit. After setting the planed side of the pedestals at right angles to the side of the pedestal jaw, by bending the straps *c c'* up or down, clamp it in that position. Now with a small straight-edge, held against the fit and against the bottom of the binder, scribe a line on binder. Do the same at the four places. Scribe lines on the edge of binder next to frame to show the right bevel to plane to.

Make the depth of recess 1-16 inch more than the distance *d e*, Fig. 1. After planing off the recess to these lines, if the work has been accurately done, the binder will drop to within ⅛ inch of the bottom of frame. It should now be fitted down 1-16 inch farther by filing when the holes may be laid out. If possible the bolt holes should be laid out and drilled, so that no reaming will be necessary, since reaming the holes weakens the frame. It is important that the hole for the wedge-adjusting bolt be in the proper position. If it is too far from the face of pedestal jaw, it will interfere with the driving box. If the hole is too far the other way, it will come in contact with the face of pedestal jaw.

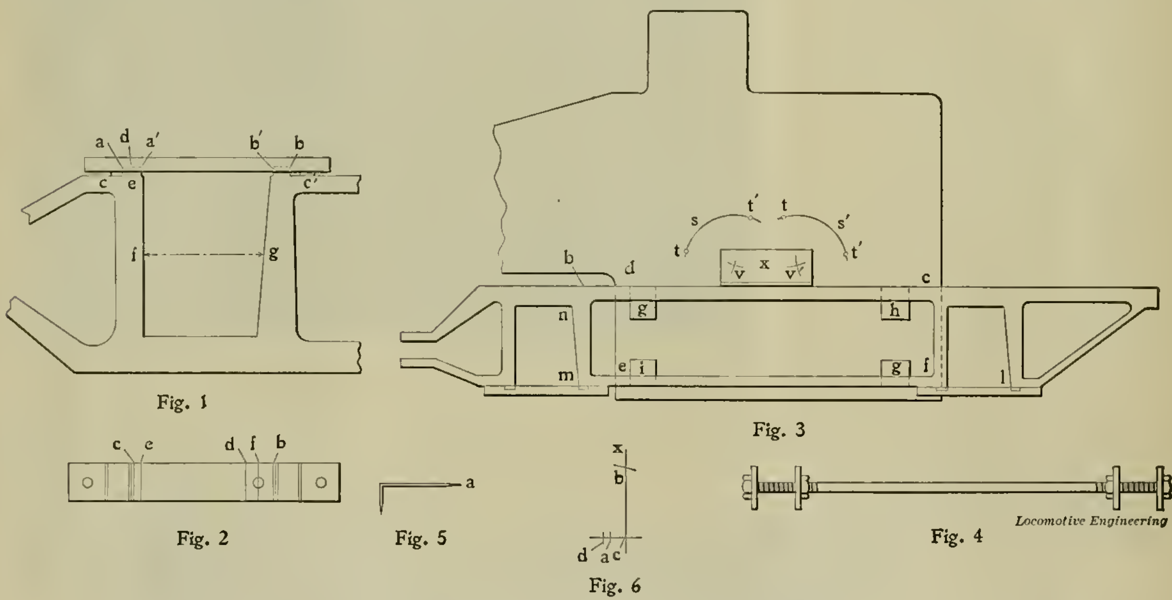
To find its proper position, proceed as follows: Fig. 2 is the pedestal binder. The line *b* represents the face of back pedestal jaw, and *c* the face of front jaw. The line *f g*, Fig. 1, is parallel with top of frame and passes through the center of pedestal. If the distance between *d* and *e*, Fig. 2, is 12¾ inches, and the driving box is 11¼ inches, it is evident that the thickness of driving shoe will be $\frac{12\frac{3}{4} - 11\frac{1}{4}}{2} = \frac{3}{4}$ inches. Hence scribe the line *e*, Fig. 2, ¾ inch from *c*. The distance between *e* and *d* equals the size of driving box = 11¼ inches. It is now plain that the space *d b* represents the thickness of the bottom of wedge. Suppose the diameter of that part of the bolt that enters the wedge to be 1¼ inches, then the center of bolt hole in binder should be 11-16 inch back of line *d*, or on the line *f*. This will allow 1-16 inch clearance between the bolt and driving box.

Having finished this part of the work, we will proceed to put frames in place. But before putting them up, the expansion plate studs should be examined carefully, and if any of them show signs of leaking, they should be replaced with new ones.

Any studs that prevent the frame liners from sliding out and in when the frame is in place should be taken out, and the new ones not put in until after liners are fitted. A die nut should be run over the old studs that are good to straighten up the thread.

Now place some blocks across the pit directly under where the pedestals will come when frames are in place, to support them while fitting the liners and buckles. Set the frame on the blocks, and then raise or lower it to the proper hight, which may be determined by using the buckles as a gage. When the frame is the right hight the buckle will slide on the studs.

Now put in the splice bolts, then fasten the deck in place. Set inside calipers to the distance between the frames at the deck. Then by means of rods and plates of iron like Fig. 4, which should be made of at least ¾-inch iron, placed one at *l*, one at *m* and one at *n*, Fig. 3, set the frames the same distance apart at these points that it is at the deck, using the calipers as a gage.



FITTING PEDESTAL BINDERS AND SETTING FRAMES.

Now run lines through the center of cylinders, letting them extend to the back end of frames. Then measure the distance from the outside of pedestal jaws to the lines. This distance should be the same at all the pedestals, but very likely will not be.

Suppose the distance from the left front pedestal to the line to be 11½ inches, and right front 12 inches. This indicates that the frames are ¼ inch too far to the left in front. To draw them over insert an iron wedge between the boiler and frame at *d* and at *e*, Fig. 3, on right side and drive them down until the frame has been drawn over the required distance, which in the present case is ¼ inch. As the right frame is drawn out, the left will be drawn in by the rods, previously mentioned, which bind the frames together.

Now insert iron wedges between frame

and boiler at *d* and *e* on left side of engine, but do not drive them down any, as these are merely to fill up space between frame and boiler to hold the frames in place after they have been drawn over.

We will now go to the back pedestals. Suppose the distance from the left pedestal to the line through cylinders to be 11⅝ inches, and from right pedestal to line to be 11⅞ inches; then the proper distance from pedestal to line on both sides is $\frac{11\frac{5}{8}+11\frac{7}{8}}{2} = 11\frac{3}{4}$ inches. Hence the frames are ⅛ inch too far to the right. Draw them to the left by means of wedges at *c* and *f* on left side, then insert wedges on right side to hold them firmly in place. Now try the front pedestals again, as setting the back ones will be liable to throw them slightly out of line. If such is the case they can be put in line again by driving the wedges farther down on the side that is farthest from the line, being careful to first raise the wedges on opposite side.

We now have the frames the same distance from the lines at all four pedestals, but something more is necessary. They must be at right angles to a line drawn across their tops. We will try them at the front pedestals first.

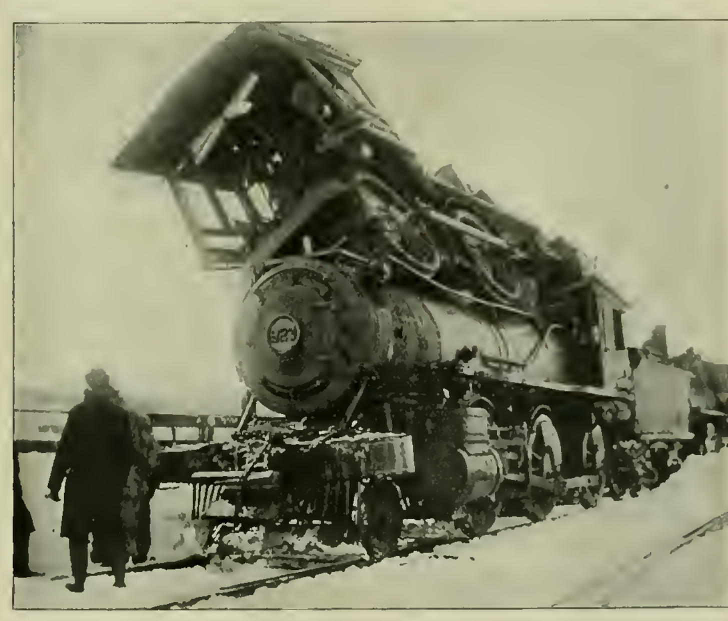
Put a straight-edge across the frames at *b*, Fig. 3, and then place the short side of a 2-foot square against the straight-edge, when the side of pedestal should be parallel with long side of square. Suppose it is found to be ⅛ inch away from the square at bottom end on left side, then the right pedestal will be that distance from square at top end, since the frames are held parallel by the rods. They could be squared up by raising the bottom wedge (in front) on right side and driving the one on left side down, but that would throw both frames about 1-16 inch too far to the left. To square them up, and at the same time keep them in line, proceed as follows:

Raise the bottom wedge on right side enough to allow the bottom of pedestal to go toward the boiler 1-16 inch, and drive bottom wedge on left side down enough to draw bottom of pedestal out 1-16 inch. This will leave them out of square the same as they were, but only half as much, and they have been drawn 1-32 inch too far to the left. Now raise the top wedge on left side enough to allow top of pedestal to go toward boiler 1-16 inch, and drive top wedge on right side the same amount.

We now have the frames square and have drawn them back into line. Proceed in the same manner with the back pedestals. The frames now have the proper position, and in order to determine whether they move or not, and to know when the liners are the right thickness, the position of the frames should be marked in some way, and a very good one is to use a tram similar to the one shown in Fig. 5. Make a center punch mark on the side of boiler, near *c*, *d*, *e* and *f*, Fig. 3; then with the point *a*, Fig. 5, in these marks scribe arcs on the frames at the four places.

Do the same on other side of engine. It is plain that these arcs must come to the same position when the liners are fitted and the buckles on. We are now ready to fit the liners *g*, *h*, *i*, *j*, Fig. 3. Generally the old liners can be used again. If they are too thin to fill space between boiler and frame, a piece of boiler plate can be riveted onto the side next the frame. If a piece of the exact thickness cannot be had, rivet one on slightly thicker than is required, then plane it down to the exact thickness.

After the liners are in place, the studs can be screwed in through the holes in them by using a stud nut.



SCOOPING UP A LOCOMOTIVE.
For Description See Page 193.

The buckles should be loose enough on frame to allow them to slide on it without binding when the boiler is expanding or contracting.

The lateral, or cross, braces can now be put on. If they are not the right length, have the blacksmith lengthen or shorten them to suit.

To lay out the holes in a new expansion plate when the studs are in the boiler, with any degree of accuracy, is generally not very easily done. The following method has been found to give satisfaction: Make a small center punch mark in the center of each stud that is to pass through the plate. Then set dividers to any convenient radius—say, 10 inches—and with centers of studs as centers scribe the arcs *s s'*, Fig. 3, on the side of boiler, and make two center punch marks *t t'* on each arc, about 90 degrees apart if possible; more or less will answer the purpose, but 90 degrees will give the best results. Now lay the expansion plate *x*, Fig. 3, on top of frame, as shown (this is not the position usually occupied by an expansion plate, but will serve our purpose), with the part that goes next to boiler against the ends of studs. If we now use the points *t t'* as centers, and with the same radius used to scribe *s s'*, scribe arcs *v v'* on expansion plate, their point of intersection will not lie in a line with the center of stud, but will be to the side of this line nearest the arc *s* or *s'*; or, in other words, the radius used was too short. The correct radius with which to draw the arcs *v v'* can be found thus:

On a board or other plain surface draw two indefinite lines at right angles to each other, Fig. 6; then lay off the distance *a c* equal to the length of the studs, and *a d* equal to the thickness of the expansion plate. With *a* as a center and the same radius that the arcs *s s'*, Fig. 3, were drawn with, scribe the arc *b*, Fig. 6, across the line *x y*. Now set the dividers to the distance *b d*, which is the correct radius with which to scribe the arcs *v v'*, Fig. 3, on expansion plate, using *t t'* as centers, to have their point of intersection in line with center of stud. Hence this point will be center of hole in expansion plate.

It is hardly necessary to say that an arc must be scribed on side of boiler from center of each stud that passes through the plate.

Cedar Rapids, Ia.

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Prompt Delivery of Papers.

We regret the delay and annoyance that have been occasioned by the failure of our addressing company to do its work properly for the last two months, and have taken steps to have this correctly attended to in the future.

We have spent a great deal of money in perfecting a new system of addressing, mailing and looking after subscriptions, and it was very annoying to have these set at naught by an incompetent addressing firm. This has now been remedied, and we trust there will be no more trouble in the future.

Ignorant Conductors of Correspondence Schools.

LOCOMOTIVE ENGINEERING has always been an educational paper, and the chief efforts of its publishers have ever been devoted to procuring articles which would be helpful to the large mass of readers who are striving to learn as much as possible about their business. We have always favored every enterprise that seemed likely to give assistance to men ambitious to improve their education, and in this connection we have at various times commended the work of the International Correspondence School, of Scranton, Pa., and other institutions of the same character, which provide an educational course that can be followed by men who are working all day. We are now sorry to say that it is necessary to sound a note of warning against correspondence schools, which are springing up in various parts of the country, and are conducted by men who are utterly incompetent to impart instruction to the men they undertake to teach.

Our attention has been lately directed to work done by a correspondence school in Philadelphia, which pretends to teach enginemen and railroad mechanics the science of their business. The method of teaching enginemen is to send out questions taken from the Traveling Engineers' examination pamphlet, or from other well-known authorities on the examination of engineers and firemen, and use the authorities from which the questions were taken to supply the answer. The men who become pupils in inferior schools of this kind are charged a high price for instruction they could take from Hill's "Progressive Examinations," which costs 50 cents. If a question not in the books is asked, the teachers show how little they know about practical railroad work when they attempt to answer them.

A pupil of a Philadelphia correspondence school with a high-sounding name, feeling dissatisfied with the instruction sheets, sent in five questions to be answered. Nothing could better show up the ignorance of the pretended teachers than the answers given to the questions. The first question reads:

"When my engine is uncoupled from train, driver brake will not stay set, but will whistle off through triple almost as soon as I apply the brake, but when coupled to train, driver brake holds all right. Will you please explain the reason for this?" The answer given was: "A leak in the coupling which unites the engine and train could very easily account for the trouble you experience, and I think you will find that there is a leak there. Of course, it would not be noticed —in fact, could not exist—on account of the pressure being uniform when the engine was coupled to the train."

That merely meant that the man answering the question did not know anything about the subject. The cause of the trouble was that the rotary valve in brake valve leaked and needed reseating. To prove what the trouble was, we would say, pump up the main reservoir pressure to 90 pounds, keeping brake valve on lap. Open bleeders on driver brake and tender auxiliaries, then cut out those brakes. Open stop-cock on rear end of tender and immerse hose coupling in a bucket of water. If bubbles rise from the hose coupling, it proves that air from main reservoir is leaking past rotary valve into train pipe. With a light engine this leakage is sufficient to raise train pipe pressure above auxiliary reservoir pressure and release brake. On train of cars, the pipe is larger and takes much more air to release brakes.

Second question is: "What is the cause of reverse lever on some engines jerking so badly when lever is near end of quadrant and engine running at high speed, steam shut off?" The answer given to this is: "This can be accounted for by the fact that when the reverse lever is near end of quadrant, the port does not open to steam until after the crank has passed the dead point."

We cannot see what the port opening has to do with making the reverse lever of a locomotive jerk when the engine is running without steam. The jerking is caused by the inertia of heavy valves in some instances, and at other times through excessive slip in the link block, and sometimes by very loose eccentric straps.

Third question is: "What is meant by wheel base and rigid wheel base?" The answer given to that is: "Wheel base is the distance from the center of the front truck to the center of the back driver, and the greater this distance, the more rigid the base."

We do not think there is an apprentice boy in any railroad shop in the country but who would laugh at this description of rigid wheel base. The answer was all right for the total wheel base, but the rigid wheel base is the distance from the center of the forward driver to center of the back one—in fact, the rigid wheel base.

Fourth question is: "In one book I have, 'One Thousand Pointers for Machinists and Engineers,' by McShane, he directs that in case the forward wheel on a ten-wheel engine breaks and has to be blocked up, that the opposite wheel must also be blocked clear of the rail in case the wheels have blind tires. Books written by Sinclair and others make no mention of this, but direct that one wheel be raised. Will you fully explain which is right, and why?" The answer given to this is: "Both wheels should surely be raised. On a straight track with no curve it would make very little difference, but where there is a curve the effect of one wheel being higher than the other is a reason for raising both wheels."

In this case McShane and the correspondence-school man who agrees with him, have the Traveling Engineers' Association and all practical men who have written about locomotive break-downs against them.

Fifth question is: "When my engine is running light, not coupled to train, I notice that with cylinder cocks open and reverse lever in corner notch and working a light throttle, that very little steam shows from cylinder cocks. Without touching throttle I move reverse lever back several notches towards center, and I notice that more steam comes from cylinder cocks and with greater force. Will you please explain why this is?" The answer given to this is: "I cannot explain why it is, but I can explain why it should not be, and the valve on your engine is surely set wrong. You say that the lever when all the way forward and the throttle slightly open, that the discharge from cylinder cock is less than when the lever is near the center. In a valve properly set this could not possibly be so, because when the lever is all the way forward, the valve has its greatest travel, and therefore the port is all the way open, and therefore the pressure in the cylinder must be equal to pressure in the steam pipe. While when the reverse lever is thrown nearer the center, the valve has not so great a travel, and if there was any difference in pressure at the point of release, it ought to be less with the reverse lever nearer the center."

That is a fine jumbling up of a very simple case. When the engine is running in full gear with a light throttle, the pressure in the cylinder is nearly uniform throughout the stroke and very light. When the engine is hooked up, there is compression of the steam which makes a comparatively high pressure at the beginning of the stroke, and of course more steam will be blown through the cylinder cocks owing to this higher pressure. Anyone who ever saw indicator diagrams would have no difficulty in understanding this case.

These answers ought to give men who are looking for instruction from correspondence schools an idea that it is a good plan to investigate the kind of teachers who are offering to teach them the science of their business. We believe that the correspondence school is destined to do a splendid work in the education of enginemen and mechanics, but to do any good they must be conducted by men who know more about the business than the men they engage to instruct.

We might add that there is no better correspondence school for locomotive engineers and firemen than LOCOMOTIVE ENGINEERING. If any man has a question about the operating of locomotives, send it to us, and it will be answered free of charge by men who know what they are writing about.

Spontaneous Combustion.

About the time of the Maine disaster, when there were numerous theories discussed to explain the theory of an internal accident, there was considerable talk about the coal bunkers having taken fire through the action of spontaneous combustion. Talking with a friend on this theory, a well-known railroad manager, who is very much of a practical mechanic, he remarked, "That talk of spontaneous combustion is a mere idle theory, got up to delude people. There never was a case of coal or any similar substance taking fire without help from the outside, and never will be."

We were very much surprised at these views, coming as they did from a sensible and fairly read man, for there is nothing more certain than that he was mistaken. Spontaneous combustion is a well-known trouble with many kinds of material, bituminous coal, when stored in large quantities, being notoriously ready to take fire from the elements of its own make-up. The substance present in coal which frequently causes spontaneous combustion is iron pyrites—that brass-looking stuff often seen in soft coal. When that substance is exposed to the air, it absorbs oxygen and forms sulphate of iron. If the air circulates freely enough to carry off the heat formed in this chemical change, which is a slow species of combustion, no harm is done, and the only change to be noticed is that the pyrites becomes white and soft. But when this species of combustion goes on in the heart of a large pile of coal, and there is no air circulation to carry away the heat, the latter increases in intensity until a raging fire ensues. The mass will smolder languidly, extending in volume until a point is reached where a supply of air can be drawn to feed the fire, and then active burning makes itself manifest.

It is well known that many buildings have been burned down by spontaneous combustion started among rags or cotton waste that had been saturated with oil or grease. Tests have been repeatedly made to find out how long a mixture of cotton waste and oil would be in starting a fire, and it was found to be very brief under favorable conditions. That is why so much care is taken in well-managed car shops and paint shops to have no heaps of greasy waste lying about.

Spontaneous combustion may be a little contrary to common-sense, as viewed by the man who believes in nothing that he has not seen, but it is one of those mysterious things which are worth guarding against.

Punctuality of Our Trains.

Since American railway men began to realize that punctuality in train operating could only be maintained regularly by the locomotives having a good margin of power for the work to be done, our railroads are gaining a world-wide reputation for the certainty that trains will reach their destination at the time scheduled. There has been a gradual improvement in this respect for the last ten years, and now there is very little to be desired in the way of punctuality, in spite of the fact that speed has been accelerated and trains made heavier. Instead of depending as formerly upon light engines pulling increased weight of train at higher speed, the operative departments have consulted with the mechanical department when heavier or faster trains had to be hauled, with the result that locomotives suitable for the work have been forthcoming. This is a great improvement over old methods, which were to put on heavier or faster trains without warning, and then abuse the mechanical department for failure to make the required time.

The writer within the month made a 3,500-mile trip, in which he broke the journey a variety of times, and not in a single instance was the train behind time, although the weather was for ten days very stormy. One experience gave a striking illustration of the punctuality of trains. The writer and a friend left Cleveland at the same hour to go to St. Louis. The distance is about 450 miles. One went by the Big Four, the other by the Wabash, and both trains were due in St. Louis at the same time. One traveler went out at the front of the fine station at St. Louis, and the other emerged by the side entrance. When the latter caught the street car, he found his friend inside. Comment is not necessary.

Poor Steel Axles.

No article used in railroad rolling stock has fallen so much into disrepute during the last five years as steel axles. When the railroads were fairly prosperous, before the panic, the men in charge of cars and locomotives began specifying steel axles for new rolling stock, and they proceeded to use the same material in repairs. This was done because iron axles were found to be too unreliable for the heavy loads they have to carry. At first the most common practice was to specify axles of open hearth steel, good quality being preferred above everything else. When the hard times came on, a feverish desire for cheapness came with them, and purchasing agents learned that Bessemer steel is very much cheaper than open hearth steel, and they did not see that the difference in quality could be in proportion to the price. The consequence was that Bessemer steel axles came largely into use.

A freight car has to run several years, as a rule, before inferior material has been tried sufficiently to demonstrate its value. Within the last six months the true value of poor steel axles has been proved by many a wreck which entailed expense that would pay for a great many good axles. The pendulum has now swung to the other extreme, and "scrap iron axles" are now the favorite, as shown by numerous specifications of cars recently ordered.

Speed Recorders and Indicators.

We understand that the Boyer Speed Recorder Company, of St. Louis, have recently received large orders from abroad. A variety of railways on the continent of Europe are applying this recorder on their passenger train locomotives and using it principally as a speed indicator. It is said that the trains are run with a much more uniform speed since this indicator was applied. This means that the work of train pulling is done at less expense for fuel and repairs, and that the cost of the instrument is saved in a few weeks.

We believe it would well repay railroad companies in this country, where trains are run at high speed, to equip their express locomotives with a speed indicator. Nearly all our engineers handling express locomotives are such good judges of speed that they manage nearly always to get their trains through on time; but it occasionally happens, in bad weather, that their judgment as to speed is at fault, and they have to make spurts of unusual fast running to make up for time lost inadvertently. These spurts mean the consumption of extra fuel, and very little of that will soon amount up to the cost of a speed indicator.

We understand that the Great Northern and several other American railroad companies have equipped a number of their locomotives with the speed recorder, and that they are very well satisfied with the results obtained. This good example ought to stimulate other roads to do likewise, for it is an investment which gives immediate returns.

Nickel Steel Staybolts.

Railroad men have had the kind of experience with steel staybolts that makes them very chary about flirting with that material in any combination, no matter what recommendations may be shown to prove that it may give entire satisfaction. If recommendations based on physical tests can be relied on, a kind of nickel steel has recently been produced for staybolts that promises to redeem the reputation of steel as a material for staybolts. In a machine designed to test the number of vibrations in any piece of iron or steel before it breaks the nickel steel staybolts displayed extraordinary endurance. That led to the material being used in the firebox of a locomotive, which is really the only test to be relied upon. In a year or two we may know something of value about this new material for staybolts.

Invention of the Steam Whistle.

It is wonderful how tenacious is the life of a lie, if it has first been started in a realistic sort of fashion. Several years ago an American magazine published a stupid story telling how the locomotive whistle came to be invented. The yarn went on to say that about 1833 an engine pulling a train on the Liverpool & Manchester Railway struck a farmer's wagon at a road crossing, and the wagon being loaded with eggs, gave a picturesque impression of the accident. The accident happened because the engineer had no means of warning the granger of the impending danger. Something must be done to prevent locomotives and wayside scenery from being daily painted with the egg coloring usually reserved for unpopular politicians. The man most competent to provide a remedy was George Stephenson, who was at once appealed to, and he promptly invented the steam whistle. Although there is not a word of truth in this story, it appears to have taken a great hold of certain editors, for we seldom go through our monthly exchanges without finding it quoted.

The true story of the invention of the steam whistle is a historical record, and is known to every person familiar with the history of important inventions. A steam whistle something in the form of a policeman's whistle was in use about the beginning of this century, and it was used largely on steamboats, before the bell or cup whistle was invented. The cup whistle was first used at the Dowlais Iron Works, in Wales, in 1830, and is supposed to have been invented by a workman named William Stephens. It was first applied to locomotives by Bury, one of the first locomotive builders in Great Britain.

The Nebraska Classification Case.

In 1893 the Legislature of Nebraska passed a law which they called "the Nebraska Classification," for the purpose of prescribing the maximum rates to be charged by railroads for passengers and freight. The enforcement of the act was vested in a State Board of Transportation, and this board proceeded to make a schedule of rates so low that the work of transportation had to be done at a loss. This was regarded by the railroad companies as a case of taking away their property without due process of law, a kind of treatment forbidden by the Constitution of the United States, and they appealed to the courts for relief. In due course the case reached the Supreme Court, and a decision was rendered last month which is equivalent to holding the "Nebraska Classification" law unconstitutional, for the reason that the rates prescribed were not reasonable. There is wrath boiling in the hearts of the Nebraska lawgivers, and they will no doubt be heard from again. Harassing railroads is too easy a means of working up cheap political capital to be long neglected. It seems to be time for Nebraska railroad men to intimate that taking away reasonable railroad earnings works injury to a great many men who are citizens of the United States and voters in Nebraska.

The Canadian Pacific Railway has given extremely low rates for passengers going to the Klondyke, and it has started a war of rates between that railway and several lines in the United States. It has also loosened the tongues of various political warriors whose voices are heard in Washington, and dire threats are in the air against our Canadian rival. "We are ruined by Chinese cheap labor," said Truthful James, echoing a superficial and idiotic sentiment. Are the United States railroads going to raise the cry, "We are ruined by Canadian cheap labor?" Our people have always boasted that they could do things cheaper and better than the Canadians, and it is a little late to begin pleading the baby act and calling for protection against Canadian railway competition.

BOOK NOTICES.

"Applied Mechanics;" a Treatise for the Use of Students who have Time to Work Experimental, Numerical and Graphical Exercises Illustrating the Subject. By John Perry, M. E., D. Sc., F. R. S., New York, D. Van Nostrand Co. Price $2.50.

This is a book of 678 pages, 5 x 7. The author, who is professor of mechanics and mathematics in the Royal College of Science, South Kensington, London, England, has made up this book principally from lectures delivered to the students of the institution named. It does not differ in many respects from the ordinary run of books on applied mechanics, except that most of the illustrations are taken from practical engineering work. Instead of taking the operation of toys to illustrate his text, he takes, for instance, the energy of a train in motion, gives bicycle problems and a variety of others, which shows that his teaching is of a life-like character and is up to date. We believe it will be found a useful book for students who are up in high mathematics.

"Arithmetic of the Steam Engine." By E. Sherman Gould. Published by D. Van Nostrand Company, New York. $1.

This is a handy little book for those who have to make calculations regarding steam engines or who wish to be more familiar with the proportions in general use. It is really a brief collection of facts and rules which the author has found useful in his own practice, and which are here presented in a simple, compact form for practical use. There are no "higher mathematics," and anyone who can work out simple formulas will have no difficulty in understanding anything in the book.

"Practical Shop Talks," by Fred H. Colvin. LOCOMOTIVE ENGINEERING, publishers, New York. 50 cents.

This is an attractive little book of 144 pages, containing twenty chapters of practical talks on shop work, shop management, and human nature generally, as brought out by shop experience. All the incidents are drawn from the author's experience and observation, and bring out points in the character of shop men and shop managers which are interesting, instructive and amusing. The author tells his story in shop language, with a vein of humor which will be appreciated and cause many a laugh as the reader recalls similar incidents in his own shop life.

The chapter containing "Looking After Details" is a good explanation of the failure of many a shop and business man.

"The Birth of Ocqueoc" is the name of a pamphlet issued by the Detroit & Mackinac Railway Company to direct public attention to the beautiful scenery along the line of that railway. The pamphlet is a work of high art, and has a colored frontispiece that is one of the prettiest pictures we have seen. Judging from the pictures shown, we would imagine the places along the Detroit & Mackinac Railway provide admirable resorts for a summer outing. The man in search of rest and amusement can have his choice of fishing, boating, hunting and wheeling, and when these begin to pall, he can go into the great woods and watch the operations of lusty men preparing lumber for the needs of civilization. The president of the Detroit & Mackinac Railway, Mr. J. D. Hawks, is a master among enterprising railroad managers, and this pamphlet appears to have his finger marks upon it. Anyone wishing to obtain a copy can be gratified on sending 10 cents to President Hawks, Detroit, Mich. We feel sure that those who send for it will be very well satisfied.

Part 10 of "Meyer's Easy Lessons in Mechanical Drawing and Machine Design" is devoted to bolts, threads, etc., and to drawing in perspective and projections. This is a point little understood by mechanics, and one which is of great value, as very often a sketch in proper perspective will give a better idea than a regular drawing. These interesting books are published by the Arnold Publishing House, 16 Thomas street, New York.

Many of the men on the Union Pacific are very much interested over a notice issued by the management, saying that the maximum age for employés will in future be sixty years. The order seems to have been rigidly enforced in the shops, eighty-two mechanics having been discharged in one week. We believe that if this rule was applied to the directors of the road that there would be a very great change in the board of management. The order looks to us like a piece of cold-blooded tyranny.

A bill has been introduced into the Ohio Legislature to compel railroad companies to furnish transportation free to the Governor and all State officers. No mention is made of forcing the companies to provide free lunches and sleeping berths, which shows that some legislators are content with a little less than the whole earth.

PERSONAL.

Mr. Richard English, general master mechanic of the Santa Fé Pacific at Albuquerque, N. M., has resigned.

Mr. C. G. Herman has been appointed master mechanic of the Cornwall Railroad, vice Mr. A. J. Reed. Headquarters, Lebanon, Pa.

Mr. G. W. Wilson has been appointed roundhouse foreman for the Missouri Pacific Railway at Hoisington, Kan., vice E. H. Charlton, resigned.

Mr. George E. Yeomans has been appointed purchasing agent of the Chicago, Burlington & Quincy at Chicago, Ill., vice Mr. Hargreaves, resigned.

Mr. George L. Bradbury, vice-president and general manager of the Lake Erie & Western, has been chosen president of the Peoria & Pekin Union.

The headquarters of Mr. T. A. Davies, master mechanic of the Wyoming division of the Union Pacific, has been removed from Laramie to Cheyenne, Wyo.

Mr. E. P. Mooney has been appointed master mechanic of the Buffalo division of the Lehigh Valley (headquarters at Buffalo, N. Y.), succeeding Mr. J. Campbell, resigned.

Mr. George R. Haskell has resigned as superintendent of the Detroit, Toledo & Milwaukee, to devote his entire attention to the superintendency of the Detroit & Lima Northern.

Mr. C. H. Small, formerly an engineer on the Canadian Pacific Railway, has been appointed to the position of locomotive foreman at Brownsville Junction, vice J. R. Crandall, resigned.

Mr. George Hargreaves, purchasing agent of the Chicago, Burlington & Quincy, has resigned to accept the vice-presidency of the Michigan Peninsular Car Company, of Detroit.

Mr. E. L. Russell has been chosen president of the Mobile & Ohio, succeeding Mr. James C. Clarke, resigned. Mr. Russell was heretofore first vice-president and general counsel.

Mr. Edmund D. Codman has been chosen president of the Fitchburg. He has been connected with the Fitchburg for a number of years, and has been vice-president since August, 1897.

W. C. Arp, superintendent of motive power of the Vandalia, and formerly with the Panhandle as master mechanic, has gone to a Western springs to undergo new treatment for rheumatism.

Mr. George R. Loyall, division superintendent of the Southern Railway at Louisville, Ky., has been appointed superintendent of the Cumberland & Ohio, recently purchased by the Southern.

Mr. A. W. Ainsworth, of Denver, Col., one of our subscribers, writes, he thinks that at the time of his first subscribing (April, 1896) he was the youngest subscriber, having been but eleven years of age.

J. E. Watkins, who had charge of the Pennsylvania's exhibit at the World's Fair, is writing a history of the Pennsylvania lines west of Pittsburg for private distribution among the officers of the road.

Mr. James Agler, division superintendent of the Southern Pacific at Ogden, Utah, has been transferred to the Western division of the same system, with headquarters at Oakland Pier, Cal., vice Mr. A. D. Wilder, deceased.

Mr. J. P. Ramsey, general manager of the Rio Grande, Sierra Madre & Pacific of Mexico, has also been appointed general manager of the Chihuahua & Pacific, to be built from Chihuahua to Topolobampo, on the Pacific coast.

Mr. George C. Jones, assistant superintendent of the middle division of the Grand Trunk, at London, Ont., has been made superintendent of the Grand Trunk & Wabash from Windsor, Ont., to Black Rock and Suspension Bridge.

Mr. F. H. Britton, superintendent of the Fergus Falls division of the Great Northern, has been promoted to be assistant general superintendent of the Western division of that system, with headquarters at Spokane, Wash.

Mr. N. K. Elliott has been appointed superintendent of the Detroit, Toledo & Milwaukee (headquarters at Tecumseh, Mich.), vice Mr. Geo. R. Haskell, resigned. He was formerly general superintendent of the Terre Haute & Indianapolis.

Mr. George W. Smith has been appointed superintendent of machinery of the Santa Fé Pacific at Albuquerque, N. M. He has been for the past nine years master mechanic of the Eastern division of the Atchison, Topeka & Santa Fé at Topeka, Kan.

Mr. F. E. Ward, secretary to President Hill, of the Great Northern, has resigned to accept the position of general superintendent of the Montana Central, with headquarters at Great Falls, Mont., vice Mr. G. R. Martin, transferred to the Grand Forks & Blackfoot division.

Mr. Joseph McCabe has been appointed general manager of the Washington & Columbia River, recently acquired by the Northern Pacific. He was formerly superintendent of the Pacific division of the Northern Pacific at Tacoma, Wash. Headquarters at Walla Walla, Wash.

Mr. Joseph Carroll has been appointed vice-president and general manager of the Mobile & Ohio, succeeding Mr. John G. Mann, who has been appointed chief engineer of that road. Mr. Carroll was formerly general manager of the Queen & Crescent, and is known as a particularly able operative railroad officer.

In the death of John Mulligan, president of the Connecticut River Railroad, who passed away last month, one of the few railroad presidents who began railroad life in the lower lines of the mechanical department has gone from us. In his youth, Mr. Mulligan learned the machinist trade, and from that went to be engineer on a tow-boat running between Hartford and Willimantic Falls. From that he went to the Boston & Albany to take a position as locomotive engineer, in which position he served for ten years. Then he advanced to be master mechanic and then superintendent of the road. From that he rose to be president, a position he held with honor to himself and pleasure to all that came in contact with him.

Fred. J. Hickey, who has been in declining health for the past four years, died at Denver, Col., on March 4th. In the passing away of this young man, a promising career has been cut short. Until ill-health caused him to abandon business, he was identified as salesman with the Schoen Pressed Steel Company, where he was rapidly building up a record to be proud of. The sympathies of all will go ont to the afflicted parents, who have been called upon to mourn the loss of five loved ones in as many years.

The steel industry owes much of its advancement to Sir Henry Bessemer, and news of his death on March 15th was sorrowfully received by all who knew him or his work. He was born in 1813, and did not turn his attention to metallurgy until 1852, and the result of his experimenting is the well-known Bessemer steel of to-day. He met with much opposition, but perseverance overcame this, and he lived to see his work a huge success. His invention and the commercial success which he made it, made possible the extensive use of steel in almost every form of construction, and Bessemer steel will prove a lasting monument to his achievement.

We have for the last few months given to our subscribers considerable cause for discontent by irregularity in the delivery of Locomotive Engineering, and we ask to be excused for the annoyance given. Towards the end of last year we were dissatisfied with the mailing arrangements that had been in use since the paper started, and we proceeded to make what we believed to be a radical improvement. It ought to have turned out that way, but, unfortunately, the agency we employed did the work so carelessly that many of the wrappers were not addressed. It was only when complaints began to come in that we realized that we had jumped from the frying pan into the fire. We then took prompt measures to have the work done correctly, and we believe that there will no longer be any cause for complaint.

Jules Viennot, of Philadelphia, well known as one of the most popular agents in the country for railroad advertising, died on March 11th at the age of seventy-three. Mr. Viennot was born in Paris, and came to this country about forty years ago. He formed a connection with several industrial papers and took a great interest in the work of the Franklin Institute, of which he became an honored member. A few years ago he was given charge of the advertising of the Baldwin Locomotive Works, and made such a decided success in looking after that business that he soon obtained the agency of numerous other concerns that did advertising in trade papers. For services performed to his native country in connection with the visits of French scientists to Philadelphia, Mr. Viennot was several years ago decorated with the ribbon of the Legion of Honor. He was an exceedingly pleasant gentleman, and his loss will be deplored by a host of friends.

From the Philadelphia *Ledger* of March 11th, we learn of the death of John Gleason, the inventor and manufacturer, who died of pneumonia in that city, in his seventy-sixth year. Mr. Gleason was born in Ireland, and came to Taunton, Mass., with his parents, when three years of age. He learned locomotive machine work, and, it is said, ran on the Vermont Central Railroad, the first Baldwin engine, named the "Governor Paine," that ran a mile in one minute. In 1857 he was engaged in construction work on the North Penn Railroad. In the meantime he was said to have invented and patented the first balance slide valve used on locomotives, and also a lathe for turning gun stocks, spokes, etc. In 1860 he began the manufacture of the lathe, and did general repair work. The lathe proved successful, and the establishment was enlarged to meet the demands of increasing business. Mr. Gleason remained in the harness up to the attack that caused his death.

The Pennsylvania Railroad officials are experimenting with a machine which is entirely new, viz., a tele-type. It is a combination of a telegraph instrument and a typewriter. It has a keyboard similar to the Remington typewriter. Two of the tele-types have been placed in this city, one at the "GD" office and the other in Superintendent Reed's office. A knowledge of telegraphy is unnecessary to operate them. When a key is touched at "GD" office it prints the letter touched on the paper in the machine at the superintendent's office, and *vice versa*.

The Arbitration Committee of the Master Car Builders' Association request that members of the association who have suggestions to make for the revision of the rules of interchange at the June convention, should communicate such to the secretary on or before April 20, 1898.

EQUIPMENT NOTES.

The Rio Grande Western Railway are to have three passenger cars built at Pullman's.

The Kansas City Belt Railway are having two six-wheel connected engines built at Baldwin's.

The Schoen Pressed Steel Company are building 200 freight cars for the Pennsylvania Railroad.

The Kansas City, Pittsburg & Gulf Railway are having five passenger cars built at Pullman's.

Wells, Fargo & Company are having four cars built by the Missouri Car and Foundry Company.

One exhibit engine for the Omaha Exposition is under way at the Schenectady Locomotive Works.

The Schenectady Locomotive Works are building twenty engines for the Chicago & Northwestern.

The Astoria & Columbia Railway are having four passenger cars built by the Barney & Smith Car Company.

Two thousand freight cars are under construction at the Michigan Peninsular Car Works for the Erie Railroad.

Four consolidation engines are being built for the Toledo, Peoria & Western at the Baldwin Locomotive Works.

One eight-wheel engine is under construction at the Baldwin Locomotive Works for the Sorocahana & Ituna Railway.

The Jackson & Sharpe Car Company are building two passenger cars for the Baltimore, Chesapeake & Atlantic Railway.

The St. Charles Car Company are engaged in building one passenger car for the Kansas City, Fort Scott & Memphis Railway.

The Baldwin Locomotive Works are constructing five six-wheel connected engines for the St. Louis & San Francisco Railway.

The New York Central people are building, at their shops in West Albany, eight steel cars for the government, to be used in carrying arms and ammunition between the Atlantic and Pacific coasts.

The Baldwin Locomotive Works have just finished the building of three locomotives for a new piece of railroad about thirty miles long, recently built in Cuba by the Spaniards for military purposes.

The Schenectady Locomotive Works have just received an order for twelve 16 x 24-inch eight-wheel locomotives for the Kiushiu Railway of Japan, the engines being duplicate of a similar order completed by the Schenectady Works for the Kiushiu Railway last fall; the previous order of twelve engines now being in operation, and rendering very satisfactory service.

Scooping Up a Locomotive.

The accident of which the engraving on page 187 is an illustration, reproduced from a photograph, was one of the most extraordinary instances that has happened in the history of railroading. The accident took place on the Clinton & Fitchburg branch of the New York, New Haven & Hartford Railroad on February 3d.

Through the neglect of a telegraph operator, an engine with a snow plow passed the station where a stop order had been received and met a milk train on the road. The engine of the milk train was scooped up upon the boiler of the snow plow engine and remained in the position shown until taken to an engine house. An unusual thing about the accident was that nobody was even hurt. There had been five men in the snow plow, but they jumped out before the collision and escaped without injury. The fireman of the milk train engine was knocked from the cab into the snow, and he escaped with a few slight bruises. The engineer of the top engine and the engineer of the bottom engine both remained at their posts, and neither was injured.

Mac's, Not Mechanics.

Some kind friend has sent us an extract from the Jackson *Patriot*, giving an anecdote reputed to have been related by Superintendent Jordan, of the Michigan Central. It says that Mr. Jordan, having been delayed by the track repairers, called to the section boss to get out a mechanic and let them get by as quickly as possible. The gang boss replied that he had a Macgee, a Macginnis and a Macguirk, but niver a Machanic.

We have too much respect for the railroad superintendent named, to believe that he was a party to scheming a new application to that ancient chestnut. We first heard it forty years ago, on the top of Birnam Hill, as applied to a shepherd. Ten years later it was published by *Punch*, with a most imposing cartoon, which showed a string of Scotch Highlanders passing through the question ordeal of an emigration office.

"Are you a 'makanak?'" (the broad Scotch of mechanic) inquires the agent of a burly Highlander. "Na, am a McGregor," is the reply.

The high-speed Westinghouse air brake has lately been applied to the cars of what is known as the Pittsburgh & Cleveland flyer. This is the fourth application, says the Pittsburgh *Post*, of the high-speed apparatus in regular service, the other three being the Empire State express, of the New York Central; the Congressional limited, of the Pennsylvania, between Jersey City and Washington, and the Black Diamond express, of the Lehigh Valley. It is growing very popular.

WHAT YOU WANT TO KNOW.

Questions and Answers.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(19) C. C., Stamps, Ark., asks how to tram an old engine having worn boxes. A.—Tram exactly as when the engine is in good condition, being careful to take up lost motion all in one direction; that is, keep the boxes against the shoes. This may be done by blocking the truck and pinching the wheels ahead in all cases.

(20) F. F., Mo., writes:

If a locomotive tank is made air tight and the injector is put to work, will it make any difference to the operation of the injector when a vacuum is created in the tank? A.—Yes; the injector will not work properly and be subject to breakage. On many roads where they used to have a wooden lining for the lid of the tank, this state of affairs often happened, and it was necessary to keep the lid raised a little to make the injector work properly.

(21) X. Y., Munising, Mich., asks:

1. What is the smallest size of single-exhaust nozzle you would use in a 16 x 24 poor-steaming engine? A.—Not less than 3¾ inches diameter. This is the average size of single nozzles for cylinders 16 x 24 inches. Engine should steam with such nozzle, and failure to do so is evidence of faulty draft appliances. 2. What diameter at top and bottom, and what length of stack should such an engine have? A.—A stack 13 inches diameter, straight, 50 inches high, is successfully used.

(22) A. B., Roanoke, Va., writes:

The main pin of an engine I was running (Vauclain compound) broke close to the hub of the wheel. I removed the parallel rods and main rods on the side having the broken pin, but not on opposite side. I had the engine towed a distance of twelve miles by another engine, using no steam. Please advise me through Locomotive Engineering, if I did the right thing. A.—No. When it is necessary to remove the parallel rod on one side of the engine, it is necessary also to remove it on the other. You were in luck having the engine towed in safety without breaking pins on the other side.

(23) L. F. C., Albany, N. Y., writes:

In the event of a boiler check permanently cocking or sticking off its seat, is it possible to prevent the escape of steam from the boiler by means of the injector? A.—An injector manufacturer to whom this question was referred gave it as his opinion, that an injector having the independent lifting jet would hold the steam in the boiler and start at any time against that pressure, giving as a reason, that the vacuum could not be destroyed with such a jet, as would be the case in forms of injector without it. An intermediate or line check between the boiler check and the injector is a good safeguard against a cocked check valve.

(24) R. Q., Marshalltown, Iowa, asks:

1. How is an American safety pop valve regulated to lose more or less steam when blowing off; has turning up of the seat into any particular shape anything to do with it? A.—The shape of the valve and seat exercise the greatest influence in determining the amount of steam lost when blowing off, and before re-seating. 2. Can an improved Nathan or Detroit cylinder lubricator cross feed? A.—These lubricators, we are assured by the builders, cannot cross feed. 3. I notice in the engravings of all Japanese locomotives, after the name, the letters "T. K."; what do these letters stand for? A.—We are not able to say what these letters signify.

(25) C. L. J., Cambridge, Mass., asks:

How does setting the link-hanger stud back of the link arc equalize the cut-off? A.—The effect of placing the suspension stud back of the link arc is to cause a late cut-off to occur at the forward port and to hasten the cut-off at the back port. This result is brought about by locating the stud so that it causes the link to occupy a different position for two ends of the cylinder; it being lower down on the rocker pin for the backward stroke, thus having a later cut-off, and higher up on the rocker pin for the forward stroke, thus cutting off earlier. The effect on the cut-off is precisely the same as it would be if the reverse lever lowered and raised the links at the proper time to cause an equalized cut-off.

(26) P. J. F., Lexington, Ky., writes:

Why do engines of some classes, all conditions being the same, use more water than others? A.—Using more water than the others means that they are using more steam to do the work. There are often accidental defects of engines that make them more extravagant steam-users than the others. A common defect of this kind is obstructions in steam ports, due to the core having moved while the cylinders were being cast. Another is defects in the draft appliances, that make one engine steam harder than the others, which will call for more steam to do a given amount of work. Still another cause for an engine using more steam than she ought to is, badly lagged steam chests and boilers.

(27) H. B., Moncton, N. B., Canada, writes:

What point of cut-off is usually taken in calculating tractive force of an engine when an indicator is not used? In the example on page 884, November, 1896, issue, 21 inches, or seven-eighths stroke, is taken. May this be regarded as standard practice? A.—The longest point of cut-off is used in calculating the maximum tractive force of a locomotive when indicator data is not obtainable, but it will be well to remember that the calculated mean effective pressure will be greater than the actual pressure. Experiment has shown that about 90 per cent. of the initial pressure may be realized as mean effective pressure at very slow speeds, when cutting off at 87.5 per cent. of the stroke.

(28) E. G. R., Mt. Savage, Md., asks:

Why are most of the eccentrics on locomotives made with a tongue at the center, about 2½ inches wide and with a bearing for the eccentric flanges at the sides of the tongue? An eccentric made with a groove about 3½ inches wide and with flanges at the sides to hold the strap which fits into the groove, is simpler to make, cheaper to fit up and more available to repairs. It is also as easy to keep oiled as many other parts of a locomotive. What is the objection to the latter style of an eccentric? Early locomotive builders used it, with good results. A.—The tongued eccentric, as first described, is a form found by long use to be well adapted to its work; it is a result of evolution more than of design. Among the objections to the eccentric having a groove to receive the strap, may be mentioned increased weight, since it must be wider to have the same bearing surface as the other. The greatest and most serious objection is the cost of changing a standard one already established, with no compensating gain in sight.

(29) W. R. A., Pittsfield, Mass., asks:

Will you please answer the following questions? 1. What is an eccentric? A.—An eccentric is a device for converting rotary motion into a reciprocating one. It is nothing more or less than a crank with its bearing enlarged so as to encircle the shaft or axle, the center of the eccentric corresponding to the center of a crank pin of like throw. 2. Can an engine be run with both forward cylinder heads gone, when both forward steam ports are covered so as to let the valves travel on their seats over the blocked ports, and engine taking steam in back end of cylinder on both sides? A.—An engine cannot run under the conditions; but instead of devoting space to the wherefore, we will use it to say that such questions can serve no useful purpose, for they are simply catch questions or puzzles. While we are always ready to impart such information as will assist to a correct understanding of the principles of locomotive engineering, we cannot undertake to be a puzzle bureau, nor clearing house for impossible situations.

(30) J. S. Toledo, O., writes:

1. I would like to know more about flat spots wearing in driving-wheel tires. Please give me full information of all possible causes for same. A.—The report of the Committee on the Wear of Tires to the Master Mechanics' Association in 1895 states the following as the principal causes of wear: Slipping at high speeds, due to centrifugal force in the counterbalance; wheels having too little counterbalance showing less wear than those overbalanced; the almost inappreciable slip at starting, and the catching of wheels to the rail after a violent slip through one or more revolutions. 2. What do you think of 1-10-inch lead for a local passenger engine? A.—The amount of lead best for an engine depends on many conditions of detail, like length of eccentric rods, length of steam ports, type of valve, etc. With long rods a greater full-gear lead is permissible than with short rods, and with long steam ports a less lead can be used than with short ones; again, an Allen valve must have less lead than is given the ordinary slide valve. It is no longer a question of how much lead to give an engine, but rather how much it may be reduced with advantage, it being well understood that the starting power of an engine is not impaired by making the valve line and line, or even blind in full gear; therefore we think 1-10 inch is rather outside the pale of economical valve setting.

(31) L., Missoula, Mon., asks:

1. Why and how does hooking up an engine increase the lead? A.—Lead is increased by hooking up for the reason that when the link is in mid-gear the center of the link block, which controls the movement of the valve through the rocker pin, is farther away from the axle, or, what is the same thing, nearer the valve, than when the block is opposite either eccentric rod pin, the lead increasing from full gear to mid-gear. This horizontal action is due to raising and lowering the link about two eccentric centers. 2. Has an engine the same amount of lead at both ends of valve; if not, why not? A.—This depends on how valves are set. Practice in this respect differs widely; in general, lead is made the same at each end, although there is a tendency to adjust leads for running cut-off rather than for full gear. 3. Say an engine is cutting off at 10 inches; if the suspension stud was central on the link saddle, how much steam would be cut off for both ends of cylinder—I mean cut off in inches of valve? A.—This question is incapable of solution without particulars of construction. The last sentence is too vague. Send sketch of valve motion and we will solve it. 4. For broken reach rod, is it correct to only block one link? If not, why not? Engine assumed to be working full gear. A.—Links should not be blocked if it can be avoided, on account of slip of link block. The tumbling shaft is the place to block up, if it is possible to do so. 5. Is same pressure in water-glass with cocks one turn open as with three turns; if so, how? A.—It is fair to assume that the pressure is not as great with the restricted opening. Wire drawing through a small opening reduces pressure. A gage will decide how much, better than a guess.

(32) J. J. C., Brownwood, Tex., asks:

1. At what part of valve travel does a slide valve move the fastest? A.—1. A slide valve moves with an accelerated motion as its center line approaches that of the seat—that is, as the valve nears the middle of its travel—and it moves the slowest as the center lines recede, or as it nears the end of its travel. 2. What effect does length of main rod have on travel of crosshead? A.—2. To answer this question it will be necessary to examine the relative movement of a piston and crank pin. In all locomotives the crosshead and crank pin are never in harmony in their respective movements except when on the centers, for the reason that the angle of vibration of the main rod causes the crosshead to over-travel its middle position during the rearward stroke, and to fall short of it in the opposite direction. This may be understood by placing the crosshead in the middle of its stroke with the crank pin below the axle, when it will be seen that the pin stands forward of its quarter position; that is, it will not be exactly under the center of the axle, showing that the crank has passed through less than one-fourth of its circular path. If now the crosshead is placed in the same position, and the crank pin is turned so as to be above the axle, it will still be found forward of its quarter position, showing that in moving from the back center on the forward stroke of the piston, it has traveled more than one-fourth of its cycle—that is, through an angle greater than 90 degrees. It is plain that a shorter rod would have the effect of placing the pin still farther forward of its true quarter position for the midstroke position of the crosshead, and lengthening the rod would have the opposite effect of placing the pin nearer its quarter position for the same central crosshead position. If a main rod of infinite length is imagined, it would be found that the crank pin would be in its true quarter position when the crosshead was in the middle of its stroke, for the reason that if it were possible to use such a rod, an arc struck from the center of the crosshead through the center of axle would be approximately a straight line in which would be found the crank pin centers, exactly above and below the axle center, when the crosshead was at half stroke, all distortion due to angular vibration having disappeared.

The Pittsburgh *Post* estimates that the output of locomotives from the Pittsburgh Locomotive Works, Pittsburgh, Pa., for the last year would make a train two miles long.

Scotch-Built American Locomotives.

The tendency towards the American style of locomotive by foreign countries, is very well shown in the annexed engravings of locomotives built by Dubs & Co., of Glasgow.

The twelve-wheel engine shown was built for the Cape of Good Hope Government, and the company named have built a great many engines of the same design. The cylinders are 17 x 23 inches, and the engine has 1,020 square feet of heating surface. It is a small narrow-gage engine.

The tank engine was built for the New South Wales Government, and is used for heavy service on short runs.

The eight-wheel purely American type of engine was built for the Intercolonial, of Canada.

The secretary of the Master Car Builders' Association requires that members of the association who have suggestions to make for the revision of the rules of interchange of cars at the June convention should communicate with him without delay.

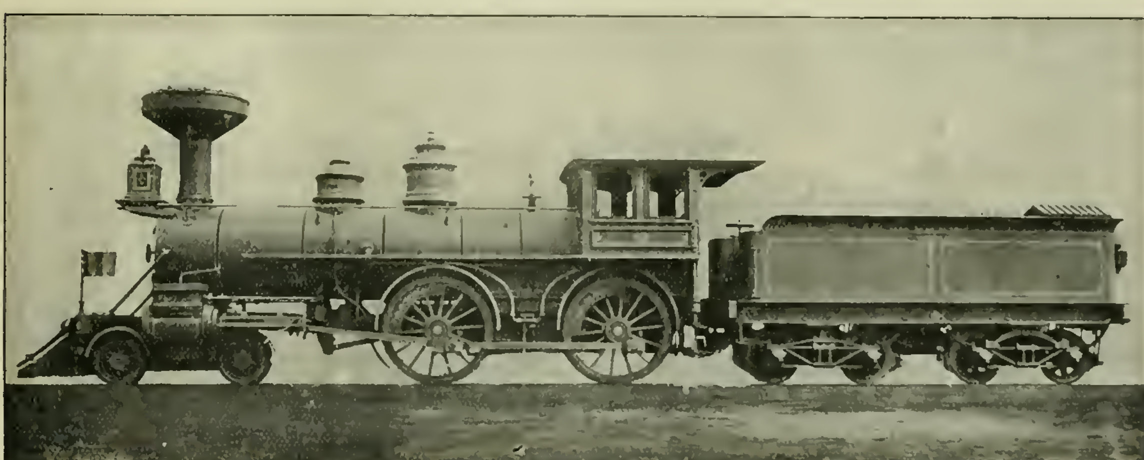
Plain Talks on the Injector—IV.

By Fred H. Colvin.

Case 1—A small injector gave trouble; would start all right and work for two minutes, then break; could not make it work longer.

The writer was called in, and, after starting the injector and having it "break" just as the party said, at once decided something was wrong with the water supply, although it seemed to be ample as it flowed from the overflow. Measuring by a bucket, as mentioned before, showed that the water supply was a little less than the minimum capacity of injector.

Further inquiry revealed the fact that the water came from a main 60 feet distant, through a ½-inch pipe (it was a ½-inch injector), which reduced the supply as stated. When the injector started,



SCOTCH-BUILT AMERICAN LOCOMOTIVES.

it immediately began to use a little more water than was being supplied to the pipe, and as soon as the small reservoir formed by the pipe was exhausted, the injector "broke." A larger pipe from the main to injector remedied the difficulty in this case. A tank, holding as much as the boiler needed for one or two feedings, could have been placed anywhere above the injector (which was a non-lifter) and fed by the pipe "between times."

Before being convinced that this was the real difficulty, the owner had another kind of injector (a lifter) put on by an agent—who, by the way, couldn't start it till the writer showed him how—in the hopes that it would "pull the water through." Needless to say, it didn't, and the suggested changes had to be made.

Case 2—A telegram called me to a little Jersey town where a three-eighths non-lifter injector was feeding a small upright boiler—when it worked at all. There was a heavy pressure of water from a tank on the roof, which had to be throttled in order to start the injector with the steam carried. It started at once, and broke as suddenly after a few minutes' run.

Investigation showed that the boiler was being forced to an almost unheard of extent. The steam would jump from 50 to 90 pounds inside of five minutes when the door was opened and coal was thrown on the fire. This variation of pressure was so great that, combined with the water pressure, the injector could not handle it. Small injectors are sensitive at best, and this was too much to expect of a fixed-nozzle injector of this size. Had the steam remained fairly steady, there would have been no difficulty, as the water could be adjusted for any given pressure, but not for such variations. A larger injector would have had less difficulty, as it would not have been so sensitive. The secret of the complaint was, that a larger boiler and engine was being installed, and the owner wished to return the small injector and get his money back, if he could make the company think it was the fault of the injector. Needless to say, he didn't succeed.

Case 3—A lifting injector this time, which, the fireman assured me, "worked all right part of the time; but sometimes it coughs and coughs, like a man wid consumption, and wouldn't work at all, at all."

By "coughing," he meant it drew in air with the suction; but how did it get it? The pipes seemed to be tight, and steam blown through them showed no leak. The supply, I was told, came from a big pipe which the suction tapped into.

Here were two chances for failure—either the suction pipe went so near the bottom of the lag pipe as not to give a sufficient area; some foreign matter, such as wood or waste, might have become lodged under one side, or the end of pipe was not submerged at all times.

As the large pipe referred to was the waste pipe for a large quantity of water used at the mill, and by following it to the discharge end, it was found that the amount varied considerably—sometimes bringing the water level within an inch or two of the bottom, and showed that the last named cause was the correct one.

The remedy suggested was to drill a number of holes, whose total area would be double that of the suction pipe, in the lower end of the suction pipe, and to place this so that the end came within a half-inch of the bottom. This gave ample area for water, acted as sort of a strainer, and, unless the water level fell more than usual, would always give a full supply. In practice it was found to work satisfactorily and to remove the difficulty.

Case 4—A small lifting injector on a yacht gave trouble at times. Owners were just getting ready for a trip to Florida, and wanted everything right in a hurry. The water tank was in the bow of the boat.

The injector would start readily and sometimes work all right; then at times it would break almost immediately. It looked as though the water supply was interrupted by a piece of wood or waste being drawn against the outlet of tank at times; but an inspection of the water tank showed it to be clear, and steam blown through suction went freely into tank without dislodging any obstructions. The trouble was evidently not here.

I went into the cabin to wash up, and had just started the water, when it suddenly disappeared and air was drawn in through the faucet with a gurgling sound. At the same time the engineer gave vent to his feelings, because the injector had "broken" again. Closing the faucets and going to the engine room, the injector was started without difficulty, and worked until the engineer opened one of the faucets, by request; then the injector broke again.

Following the piping, it was soon found that the water supply for the injector and for the faucets both came from the same main pipe—in fact, the faucet supply was tapped directly to the injector supply. Whenever the faucet was opened, the injector would draw the water away from the faucet, and the air rushing in would cause the injector to break. This shows the importance of giving the injector an independent water and steam supply. Changing the piping soon remedied the difficulty, and the yacht went to Florida on time.

Case 5—A non-lifting locomotive injector of small size failed to work, and the engineer registered his little kick in consequence.

Examination of the tubes showed a quantity of fine coal in the tubes, which almost completely blocked the passages.

Further examination of the tank (it was a saddle-tank engine) showed a large quantity of the same coal, evidently put there for the express purpose of causing trouble. He was ordered to clear out the tank, and was informed, in a mild tone, that "an injector was to force water into the boiler, and wasn't a coal conveyer." This kind of an accident sometimes happens when rival salesmen are around.

New York Air Brakes Must Come Off.

The Westinghouse Air-Brake Company have issued a pamphlet giving the text of the decree of the Circuit Court of the United States, dated January 4th, requiring the removal of infringing New York air brakes from the cars of the Buffalo, Rochester & Pittsburgh Railway. The railroad company named is required to remove at least 250 of the infringing apparatus within thirty days, and at least 250 more within sixty days, and 250 more within ninety days, and the balance in 120 days.

In commenting upon the decree, the Westinghouse Air-Brake Company say that three series of competitive trials made with Wesinghouse and New York air brakes in 1892 proved the latter to be about 20 per cent. less efficient than the former, and that the presence of the New York brake mixed with the Westinghouse in a freight train caused injurious shocks. Owing to this and to the belief that the New York infringed on the Westinghouse patents, the latter company warned the railroad companies proposing to apply the New York air brake of the risk they ran. In spite of that, the B., R. & P. not only applied the New York air brake to their cars, but after the courts declared that the first triple valve infringed the Westinghouse patents, the railroad company named applied another New York brake to their cars which was a worse infringement than the first one.

At different times the New York Air-Brake Company have sold four different forms of air-brake apparatus, three of which have been enjoined by the courts, while the fourth is the subject of a suit for infringement. In spite of the publicity given by the various suits against the New York Air-Brake Company for infringement of the Westinghouse patents, the B., R. & P. Railway people pleaded that they were innocent parties in the purchase of the infringing apparatus. The court did not, however, take any stock in the innocence plea, and gave a summary order to have the brakes taken off.

We have received a notice from Vice Consul Peterson of Sweden and Norway, that the royal administration of the Swedish State Railways invite civil engineers or others interested to a competition of designs for the arrangement of new railroad stations, junctions, etc., in the city of Stockholm. Particulars concerning the work will be furnished by Mr. August Peterson, Le Droit Building, F and Eighth streets, Washington, D. C.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Fifth Annual Convention of Air-Brake Men.

The following arrangements have been made for the fifth annual convention of the Air-Brake Association, to be held in Baltimore, Md., April 12, 13 and 14, 1898.

The Carrolton Hotel, located on Baltimore, Light and German streets, will be headquarters, where the following special rates have been made for the members of the association and their friends: Rooms on first and second floors, $3 per day for each person; should four persons occupy the same room, $2.50 per day; rooms fourth, fifth and sixth floors, $2.50 per day; rooms with baths, $3.50 per day.

The convention will be called to order by President McKee promptly at 9 o'clock Tuesday morning, April 12th, in the Dushane Hall, Rains Building, No. 409 Baltimore street, two blocks from the hotel. Members are especially requested to be present at the roll-call.

Proper arrangements have been made for the entertainment of the members and their friends during such times as the convention will not be in session. The Pennsylvania Railroad Company will run a special train from Baltimore to Washington for the use of the members and their friends who desire to see the sights of the capital. Members should apply at once for transportation, through the officials of their respective roads, who will no doubt produce the same cheerfully.

On arrival at Baltimore, members getting off at Camden station can take a street car direct to the hotel. Turn out, every one, and make this convention even a more successful one than those preceding. Bring the ladies, for the sights of Baltimore and Washington are worth traveling many miles to see.

Air-Brake Instruction Cars and Plants.

The importance of proper air-brake instruction is becoming more generally recognized by railroads throughout the country, and it is now rare to find a road which has no place where their employés may go to receive instruction in this important branch of railroad work. There are a few roads, however, which are entirely without, or have but inadequate instruction facilities. One large trunk line until recently had not the slightest pretense of an instruction plant, and in consequence ambitious engineers, firemen and train men on that line were obliged to beg instructions from a smaller, competing line's air-brake school. Men from the larger line frequently deadheaded fifty miles to attend this school. Finally the crowd of foreigners became so large that the attention of the trunk-line officials was called to the fact, and instruction facilities were promptly forthcoming.

There has been a too common disposition to let men "pick up" their air-brake information. This is wrong and expensive practice. The instruction room or instruction car is a better place to take off the rough edge of wrong practice and inexperience than actual service. Afterwards, when a man shall have learned what he should do and what he should avoid, and how desired results are to be obtained, he may be trusted to apply to train braking that which he has learned from the instructor in the instruction car or plant; but it is expensive folly to teach a man the rudiments of air braking by placing him in charge of a train of air brakes without any preliminary training, and let him "pick up" his knowledge. A single wrong application costs money. Many dollars' worth of damage is done by ruining merchandise, knocking down stock and breaking in two—all of which is due to wrong handling, and which might have been avoided by a proper course of instruction at the outset. A skilled air-brake engineer holds a mastery over a train that will secure faultless service; while, on the other hand, an unskilled air-brake engineer will, in a short time, lose more money to his company than would fit up a first-class instruction car or plant and hire a first-class instructor. A violin in the hands of a skilled performer entrances one with its sweet music; but the same violin in untrained though zealous hands produces a decidedly contrary effect.

An instruction plant is not had when a single-sectioned plain triple, sectioned drain cup and hose couplings have been thrown on the floor in a dark and dingy corner of a dark and dingy room, where a rheumatic 6-inch pump works spasmodically in a darker and dingier corner. Yet, on several of our most pretentious railroads there are several such counterfeits masquerading as air-brake instruction rooms. A sensible plant should have at least full equipments for engine, tender, freight and passenger cars. Where possible, twenty or thirty freight car equipments should be fitted up to show different effects in train braking. The plant should be placed in charge of a competent instructor. We use the word "competent" literally, and do not mean thereby a man who can merely talk air brakes glibly and impress his hearers with his own personal knowledge, but instead we mean an instructor who can convey air-brake knowledge to his men and thereby bring about improved results in train braking. A good instruction car or plant in charge of a good instructor will prove one of the greatest money-saving institutions in railway service.

Air Brakes Encroach on the Baby's Domain.

One need not necessarily have had to do with air brakes very far back to remember the red rubber ring used in the first form of feed valve attachment sent out. One day, while the experience which led to the abandonment of the rubber ring in favor of the metal packing ring and diaphragm was coming in, an engineer from a comparatively small railroad up in the West Virginia mountains strolled into the W. A. B. Company's exhibit at the World's Fair, Chicago.

"Beg pardon," said he to the attendant, "but can you tell me whether your company supplies, in small orders, the rubber packing ring for the feed-valve attachment?"

"Certainly," replied the attendant. "Have your master mechanic send us a requisition, and you will be supplied with any number you want."

"Mighty glad to know it," replied the engineer. "You know, these rings wear rapidly and soon have to be replaced. I ran my valve for two weeks with a leaking packing ring, and one day while in the village drugstore I found that the rubber teething ring kept there for babies, fitted the feed-valve piston perfectly. I bought two rings, and when they were worn out I went back for more, but owing to the recent numerous arrivals of babies in the neighborhood, the demand for teething rings had exhausted the supply, and we engineers have had to fall back on asbestos and candle-wicking. Thank you. Good day."

The Conductor's Valve in Europe.

The emergency apparatus for putting on power brakes is in every compartment of a European car, and consequently out of sight of conductors and brakemen. A card attached gives notice that it must be used only in emergencies under penalty of a fine. But probably in nine cases out of ten when it is used at all it is mistakenly used. A lady has been known to put on brakes when she thought she was regulating the heat in the compartment, and recently an Italian traveling in Germany used one as a bootjack; he got his boot off with it, and at the same time stopped the train and was fined 30 marks.—*Ex.*

CORRESPONDENCE.

Regarding Mr. Blackall's Test for Train-Line Leaks.

Editors:

In your February number the article on the proper test for an engineer to make for train-line leaks, by R. H. Blackall, is a little misleading, or perhaps not so much the article, which is good, as the theory of the black hand falling as the train-line pressure falls. While this is true with a large percentage if not the majority of brake valves, it is misleading in all cases and radically wrong.

When a brake valve is new or in perfect condition, as the black hand is connected to chamber *D*, it has no connection with the train line when the valve is on lap, and any leak it may show is not the leak of the train line so much a .ie leak of the packing ring of equalizing piston 18, and if it were tight, as I have seen, the train line might leak to 0 and the black hand still remain the same. Then again, the train line might fall 20 pounds and the black hand show only 5 or 10 pounds.

Now, this being true, would it not be a good plan to test your valve first? Put it on lap after making a 5 or 10-pound reduction, then let some air out of your train line with the angle cock, and watch your black hand. If it falls rapidly, Mr. Blackall's test is all right; but if it falls very slowly I should conclude it better to be governed by speed of the pump in supplying the leaks than by the test of the falling black hand.

A. W. Collom.

Meadville, Pa.

A Good Attempt.

Editors:

In answer to Mr. E. Milhone's problem, on page 157, March number of Locomotive Engineering, I would say: In connecting engineer's valve a leak was left in one of connections to equalizing reservoirs. This leak might also have been one of the unions in air pipe to train-line pointer (No. 15 or next to gage). The feed valve attachment not being adjusted, the tension of spring 68 happened to be about 20 pounds. The governor was set at 95 pounds. After applying the brakes in emergency, handle of engineer's valve being put in release, chamber *D* and equalizing reservoir would charge to 60 pounds feed, valve 63 closing. Pressure in chamber *D* and equalizing reservoir would then reduce through leaky connection, train-line pointer falling to 20 pounds (the tension of spring 68), when feed valve 63 would open and supply leak; this leak being about equal to air passing feed valve.

H. Thornburg,
N., C. & St. L. Ry.

Paducah, Ky.

Handling Long Air-Braked Trains.

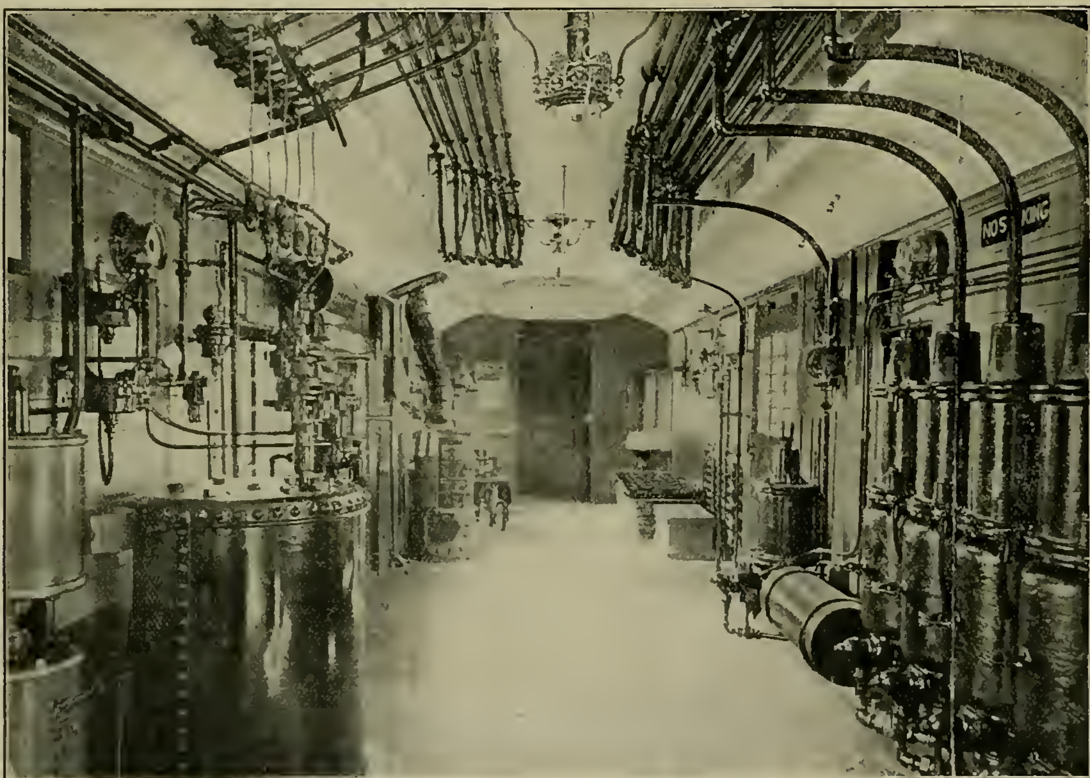
Editors:

Referring to E. W. Pratt's handling of sixty cars of air, that appeared in your February number, I think it is very instructive to a great many that may be called out some time with a sixty-car air train. Nevertheless, I think there is a mistake made in cutting driver brakes into straight air in order to hold them set while train brakes are releasing. Would it not be a saving of excess pressure to cut driving brake out just before releasing? It would then stay set until it was cut into automatic again. I think there would be a considerable saving of excess pressure with the cut-out and cut-in plan.

E. B. Thrall,
Engr. B. & M. R. R.

Plattsmouth, Neb.

F. W. Olin, St. Louis, Mo., has been granted a patent for an air-brake pump which is operated from the axle, and is thrown in and out of gear by an automatic governor.



AN INTERIOR VIEW OF THE NORFOLK & WESTERN R. R. AIR BRAKE INSTRUCTION CAR, SENT BY JOHN W. WARD.

Testing for Train-Line Leaks.

Editors:

I notice in February number of Locomotive Engineering an article written by Mr. Blackall, of the D. & H. C. Company, relative to enginemen testing for train-line leaks.

The instruction given therein, to my notion, are not quite correct. For instance, when we make a 5-pound reduction and lap the valve, the black hand denotes only the remaining pressure in the equalizing reservoir.

If the black hand falls at this point it would denote a leaky packing ring in equalizing piston or gasket, and we would lose a portion of our equalizing feature. There must be a dividing line in order to get this feature. If the packing and packing ring are tight in lap position, the black hand would not fall with the train line entirely empty.

We have not got a valve on our road that would denote a leaky train line in the manner recommended by Mr. Blackall. I will admit, however, that if the piston packing and train line leaks are equal, then on lap position the black hand would denote a leaky train line; but this information is not reliable. All of us in this locality rely upon the Locomotive Engineering as being the greatest source of reliable information and instruction obtainable. We also use Conger's "Air-Brake Catechism," and consider it of vast benefit in a general way. I really think that Mr. Blackall makes a little mistake, if he recommends this practice as a reliable test for train-line leaks.

I would recommend charging train to maximum pressure and then shutting off the pump, and watch the gage. Now if the black hand falls with valve in running position, we know we have a train-line leak. This is a rule we follow on our road, and find it works to perfection. I think this is correct. If I am wrong, I would be pleased to be corrected.

C. F. Hammond,
T., St. L. & K. C. Ry.

Frankfort, Ind.

INTERIOR VIEW OF NORFOLK & WESTERN R. R. AIR BRAKE INSTRUCTION CAR.

Test of a Broken Graduating Pin.

Editors:

In a recent issue of Locomotive Engineering, it was mentioned that one of the causes for quick action in service, irrespective of length of train, was a broken graduating pin.

There must be some mistake about this, as the writer has found that quick action could not be got on a freight train of over five cars, with broken graduating pin and graduating valve secured to its seat (triples clean).

With a longer train the brake on car with broken graduating pin would apply in service apparently as on the other cars, with the exception of a little later start.

Was it not caused by the leakage of emergency piston causing a reduction to auxiliary pressure to equal the rate of the train-pipe pressure reduction?

C. R. Ord,
A. B. Insp., C. P. R.

Toronto, Can.

[The triple used by our correspondent was most probably clean and well oiled. If this were so, it is possible that the graduating spring so nicely controlled the piston movement that the port to top of emergency piston was so slowly opened as to permit the auxiliary pressure going to push the piston down, to instead pass to the cylinder around the loose piston. No doubt too many irregularities are blamed to broken graduating pins, but when the quick-action triples were first placed in service, the trouble from broken graduating pins was so great as to cause the manufacturers to change the form of the pin. In service, where triples suffer neglect, a broken graduating pin would more readily manifest its presence than in a special test.—Ed.]

The Westinghouse Brake in Italy.

The company working the Southern Italian railroads has discarded the Hardy brake, and will substitute for it the Westinghouse brake. The change is to be made first on 140 locomotives, 158 passenger cars and 45 baggage cars.—*Ex.*

Long Air-Braked Trains—Location of Main Reservoirs.

Editors:

I have read Mr. Pratt's article on "Handling Sixty Cars of Air," and would say that in the valleys out here, where we handle from sixty to seventy cars of air, we cut the train-pipe pressure to 60 pounds. Now it is almost an impossibility to make a slow down with one of these long trains, and throw the brake off before coming to the dead stop without the train breaking in two or probably more pieces. It can be done, though, as this writer says, by turning the full pressure of the main reservoir into the driving brake cylinders. This, however, might lock the drivers. The best way to hold in the slack, we find, is to screw a ¼-inch or ⅜-inch pipe into the triple exhaust of the tender triple. Run this pipe up near the right-hand tank valve, and screw a plain stop-cock into it. Before releasing the brakes, the engineer closes this cock, and thus has almost the full pressure on the tender brake while the brakes on the train are releasing. There is not much danger of the engine sagging ahead then and breaking train in two. Do not think that the pressure-retaining valves are good for this trouble, as they will not hold enough air or hold it long enough.

I am sending you a photograph of an engine on the Nevada, California & Oregon Railway (a narrow gage), where the main reservoir is located on top of the boiler, right back of the stack. Mr. Gest, vice-president and general manager of the road, wished to forestall a possibility of the main reservoir being knocked off by snow if placed under the engine, and for this reason it was placed on top. To do this, the bell frame had to be placed back of the sand box. The engine looked a little odd at first, but the oddity wears off when you become accustomed to it. The piping and connections are all easy of approach, like the outside plumbing on all new houses nowadays. The reservoir is drained by a ¼-inch pipe and globe valve.

H. C. FRAZER.

San Francisco, Cal.

N., C. & O. R. R. ENGINE, WITH MAIN RESERVOIR ON TOP OF BOILER.

Movement of Air-Brake Cars on N., C. & St. L. Railway.

Editors:

Thinking possibly it might be of interest, I hand you herewith report of air-brake cars leaving Nashville over our Chattanooga division during the month of January:

Freight trains out of Nashville yard:

Average number of cars in each train	19
Total number of air-brake cars forwarded on such trains	1,915
Air-brake cars "O. K."	1,794
Air-brake cars cut out	121
Average serviceable air-brake cars to train	4.5

Of the cars cut out there were:

Triple valves out of order	3
Triple valves gummed up	8
Sand holes in triple valves	1
Release valves leaking	4
Broken cylinders	2
Broken cylinder gaskets	2
Broken auxiliary reservoirs	1
Release springs broken	2
Piston packing leather worn out	1
Broken main pipes	1
Piston heads broken	1
Brakes would not apply	2
Leaking out of exhaust port or pressure-retaining valve	29
Brakes leaked off	4
Brakes would not release	5
Broken branch pipes	7
Brake rigging out of order	8
Defects not shown by report	8

Almost one-third of the cars upon which the brakes were cut out were cars belonging to private car lines.

J. W. THOMAS, JR.,
Asst. Gen. Mgr., N., C. & St. L. Ry.

Nashville, Tenn.

Loose Pointer Did It.

Editors:

Following is the solution to my problem in last number of LOCOMOTIVE ENGINEERING:

The black pointer was loose on its spindle. By putting the handle in release or running position, the pointer would go to 60 pounds, but no farther. The jar of the pump when returning is what caused the pointer to drop back to 20.

ERLE MILHONE,
K. C., F. S. & M. R. R.

Kansas City, Mo.

In reply to inquiring readers we will say that Trojan grinding compound is made in four grades, namely, "Coarse," "Medium," "Fine" and "Extra Fine," and is manufactured and sold by M. C. Hammett, 476-480 Eighth street, Troy, N. Y.

Fifth annual convention of Air-Brake Association, Baltimore, April 12th, 13th and 14th. Headquarters, Carrolton Hotel.

Waterspout Markers.

Editors:

As I have had quite a number of inquiries in regard to the water spout markers in use on the Boston & Albany Railroad, I thought a description of them would be interesting to the readers of LOCOMOTIVE ENGINEERING.

This marker has been in use at all the water spouts on the main line for some time, and has greatly improved the air-brake service. It not only enables the engineer to make smoother stops, but it saves him time, by enabling him to know when he has stopped right, without having to wait for the spout to be pulled around and someone to tell him. This is important on trains with only two minutes allowed for taking water and oiling around.

It has been said that freight trains making water-spout stops, should stop four or five car lengths short, cut the engine off and pull ahead to spout. This is undoubtedly the proper course to pursue when taking water at a spout on a heavy descending grade, the grade and train being so heavy that running by and backing up is not possible.

It also may be the proper thing to do with an exceedingly long train, but, to my mind, it is not necessary with a train which does not exceed forty cars. With such trains, and engineers who have had proper air-brake schooling, markers at all the water spouts, and engines equipped with the new air gage, known as the Semaphore, which is the best thing brought out since the '92 model of engineer's valve, to improve air-brake service, emergency application will be a thing of the past in making these stops.

The marker, as can be seen by the cut, is in form a large letter "T." It is made out of ordinary steam pipe; the upright piece is 2½-inch pipe, with a flange 6 inches in diameter screwed on one end, and a tee, 2½ by 1 inch, on the other. Into the tee are screwed pieces of 1-inch pipe with a cap, which form the arms. It is important that they be of such hight that the engineers may obtain a good view of them from their cab windows, and when there are engines with many different hights of cabs running on the road, care must be taken, when determining the standard hight, that it is not too high for the lowest and not too low for the highest of them.

The uprights are bolted, by four ½-inch bolts, through the flange to a stone 3 feet long by 1 foot square, set in the ground so that the top is on a level with the top of the rail. The stone is set on the right-hand side, ahead of the spout, and as near the track as safety will permit. This distance is the most particular thing connected with the erecting of the marker, and difficult to determine on account of the difference in length of engines.

When the center of man-hole in tank is directly opposite the upright to spout, the upright to marker should stand opposite the cab at a point as near in line with the engineer on the different classes of engines as possible. This being determined, is the distance that all uprights to markers must be set ahead of center to upright of spout.

Suppose this distance to be 20 feet, then 20 feet should be measured off on every engine, from the center of the man-hole on the tank, and this point should be marked in the cab by a brass star, that an engineer can readily see what part of the cab must be opposite the upright of marker to have the center of man-hole opposite the center of water spout.

With that style of spout, which swings from right to left and which is in use at all the tanks on the main line of this road, it is now necessary to ascertain at every spout, with an engine having the smallest diameter of man-hole in use on

DESOE'S WATER-SPOUT MARKER.

the road, the distance from a point, with the man-hole directly opposite the center of upright to spout, which the engine can be moved ahead or back, and yet be able to take water.

This distance is the length to make the cross-arms, and the sum of the length of the two is the range of stop, which will vary for the different spouts.

A spout never should be so long that water cannot be taken when the man-hole in tank is directly opposite the center of upright to spout.

E. G. DESOE,
A. B. & S. H. Insp., B. & A. R. R.
Springfield, Mass.

A "Baltimore" bar will be added to the Air-Brake Association badge. Members should see that they get this additional bar from Secretary Kilroy.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(36) R. F., New Orleans, La., writes:

I would like to ask you a question about D-8 valve. When you put the handle in full release position, air comes out of the valve fitting. Where does it come from? A.—It is air from the main reservoir on its way to the train pipe.

(37) T. B. H., Wickham, Newcastle, New South Wales, asks:

With everything in good order, can emergency take place when the driver makes a service application? I say it cannot; another driver says it can? Who is right? A.—If the triple valve and equalizing piston of brake valve are in proper order, and the usual length of piping on engine, tender and car is employed, the quick-action feature of the triple will not be brought into play when a service application is made with the brake valve.

(38) F. P., Montevideo, Minn., writes:

Why does engineer's equalizing discharge valve (D-8, 1890) stick up and refuse to seat only when valve is jarred by striking. Cylinder, piston, piston packing ring, guide for stem, on being examined by machinist, appear to be in perfect condition. Action of valve, on drawing off 5 or 6 pounds, equalizing valve seems not to start until 1 or 2 pounds is drawn. A.—The equalizing piston probably fits too tightly in its cylinder, requiring considerable reduction to cause it to rise. When it does rise, however, it goes clear up against the gasket. Ease up the piston packing ring by grinding it in its cylinder with a little oil.

(39) W. R. S., North Platte, Neb., writes:

1. If the graduating valve leaks on triple valve, what effect will it have on brake, and how can I detect it? A.—1. See "A Leaky Graduating Valve," on page 99, February number. It is about impossible in practice to reliably detect the difference between the leaks in the graduating valve and slide valve. 2. If leak is under slide valve how will I detect it? A.—2. Answered in A. 1. 3. If graduating spring is too weak, how will I detect it? A.—3. There will be a tendency for the triple to go into full application with a service application. 4. If piston packing ring is worn bad, what effect will that have? A.—4. The air sent from main reservoir into train pipe to release brake will pass by the packing ring into the auxiliary without moving triple to release, and brake will stick.

(40) R. P., Two Harbors, Minn., writes:

Westinghouse takes 70 pounds as standard train-line pressure, and says that in a full service application the auxiliary and brake cylinder will equalize at 50 pounds to the square inch, and in an emergency application they will equalize at 60 pounds to the square inch, or about 20 per cent. greater braking power will be obtained. What rule would you use to find the pressure at which your auxiliary and brake cylinder would equalize in both service and emergency applications if your standard of train-line pressure was greater or less—say, 80 pounds, which is generally carried here? A.—1. See "Train Pipe Air in Quick Action," by Mr. Kelly, and editorial comment thereto, on page 762, October, 1897, number. 2. If you carried 80 pounds train-line pressure and made an emergency application, would you obtain more than 20 per cent. greater braking power than you would with service? A.—2. The increase would still be about 20 per cent.

(41) P. S. W., Fall River, Mass., writes:

I am running an engine with a D-8 brake valve. A short time ago had much trouble with driver brake releasing when coupled to four or more passenger cars. With light engine, or with two-car train, a 5-pound reduction would keep brakes set indefinitely; but as soon as two more cars were coupled in, driver brake would release immediately upon the engineer's valve being lapped. Found preliminary exhaust port a little large. Had this fixed to reduce 20 pounds in about 5½ seconds. This only helped the trouble slightly. I then cleaned the equalizing piston and triple valve without benefit. On taking triple valve down a second time, I found that spring holding slide valve to seat was very weak. I put in a stiffer spring, and the trouble ceased. Could this spring being weak have caused this trouble? If so, how? A.—See answer to question 32, on page 160, March, 1898, number. This tendency is greater if the equalizing piston does not work freely. Stiffening the spring on back of slide valve, as you did, would tend to bring about the results you obtained.

(42) W. W., Temple, Tex., writes:

While out on the road the other day, I had a D-8 brake valve bother me considerably. Whenever I carried excess and would go to make a service application, equalizing discharge valve would stick up. Valve acts pretty when not carrying excess. Black hand on gage shows 45 pounds, and red 85 pounds. Black hand always falls when placed to carry excess. Examined pipe connection to brake valve reservoir and found no leaks. Raised rotary and found it somewhat gummed and slightly cut. Please explain, and oblige. A.—Inasmuch that main reservoir (excess pressure) is cut off while an application is being made, and can therefore have no effect on applying brakes, we conclude the correspondent means that the equalizing piston rises and discharges air when handle is thrown to release position. If the train is short, the piston is more liable to rise and discharge air than if no excess is carried. The occurrence is not serious, and can be made less by returning valve handle to running position shortly after placing in full release. It is caused by the port to the train pipe (under the piston) being larger than that to chamber *D* (above the piston). If this mode of releasing is followed, the black hand dropping back will also be corrected.

(43) W. H. L., Philadelphia, Pa., writes:

1. I overhauled engine brake valve, '92 style, also triple on engine and tender. All pipes and connections were perfectly tight. Applied the brake with 5-pound reduction. Piston would not move. Made a second reduction, and piston would not move yet. Made a third reduction, and brake went on. Please advise why brake would not go on with first and second reduction. A.—1. The piston-packing leather was probably leaky, or leakage groove in cylinder was too large, and allowed air to pass out of the cylinder. Possibly the piston packing was stuck tight and needed the third reduction, which may have been heavier, to pull it loose. 2. I have an engine that signal whistle will blow with five cars and no more. Please advise how I can make whistle blow with any number of cars. A.—2. The whistle stem is probably too loose, or the car discharge valves are not entirely clear. Note if the old-style strainer is in the car discharge valves. If it is, cut it out and ask your master mechanic to send to the W. A. B. Company for late style T-strainers, which are put in the main pipe.. 3. What is your opinion of an air-brake machinist, with one helper, that takes care of 120 engines, eighty-seven 9½-inch pumps, thirty-three 8-inch pumps, overhauls all brake valves, also the triple valves; does all the pipe work, and makes his own hose for engine and tender? A.—3. If he does all this work, and does it well, he is certainly a hustler. The Air-Brake Association should get him and assign him to committee work, and his master mechanic should see that such an omnipresent man doesn't get the war fever.

"The Economical Handling of Locomotives."

BY EUGENE MC AULIFFE.

The successful firing or running of a locomotive calls for the exercise of tact, a kind of nicety of touch or action. Without it the crew may get their engine and train over the road, but they only stumble over it; they lack that smoothness that is essential to a comfortable, safe and economical performance. Some men never seem to acquire that skill ; it is as unreasonable to expect every apprentice to make a successful engineman as it would be to expect every schoolboy to develop into a successful doctor or lawyer, but any man can improve his skill, and the more incompetent should seek admission to some other branch of the service, where they oftentimes succeed admirably. Engineers and firemen should work in perfect harmony, and both should figure closely on future contingencies. Meeting points are more easily made when calculated some time ahead, as it is much easier to make up a couple of minutes between each of three or four stations than to try to rush three minutes work into one at the last. Before starting, the boiler should be well supplied with water for the reason that most engines steam best when a fair supply is carried; the cool water fed by the injector when entering a large body does not have the chilling effect that it does when mixed with a smaller quantity. Besides, when the water level is fairly high, the injector can be temporarily shut off when an extra demand for power is made. Too high a water level on the other hand is detrimental.

Between washings, the large amount of foreign matter held in suspension in all waters accumulates in the boiler, forming a surface scum that is carried over with the steam. This not only partially destroys its effectiveness, for the reason that steam has not the expansive power when wet that it has when dry, but the soda, potash, ammonia, and other chemicals of an alkaline nature, have an insatiable appetite for lubricants, eating them up as fast as applied. As a result, the valves and cylinders suffer from the friction incident to the contact of iron moving on iron, when destitute of that film of oil that is absolutely necessary to smooth running. With the balanced valve commonly used the cylinders require more oil than the valves; that is to say, the quantity that will keep the valves and valve seats in good condition is not sufficient for the cylinders; on the contrary, the engineer can rest easy about his valves, if he is certain the cylinders are getting sufficient oil.

The quadrant on all locomotives should be finely notched; there is a limit beyond which it is not economical to hook the lever back, this limit varying under different conditions, the atmospheric temperature being perhaps the greatest factor, but the engineer handling a heavy train must not neglect to move his reverse lever when the grade changes. There are few roads in this country that admit of setting the reverse lever in any particular notch for any great length of time. When "going into a hill," the lever should be dropped gradually and not sent to the corner in three or four installments of six or eight notches each. It is surprising what a reduction in the consumption of water the careful handling of the reverse lever will produce, and a proportionate saving in heat can be made by raising and forcing the feed water into the boiler with the smallest possible opening of the injector throttle. To secure the best service from any injector it should be well packed, all joints, particularly in feed pipe, absolutely tight. Some engineers imagine that the greater amount of steam mixed with the feed water heats it to a higher degree, and the steam used is returned to the boiler in this way, but that it is more economical to keep it there in the first place, observation will teach. Some men work their injectors with ¾ of a turn of the throttle, the lazy cock cut up to the gurgling point, while others seem to require three or four turns, and the lazy cock in line with the feed pipe.

It may not be amiss to mention the fact that injector throttles need not be closed so tight as to grind the valve into the seat; in fact they are seated by steam pressure and the mere contact of valve on seat is sufficient. It is not uncommon to find men who insist on closing all valves, gage cocks, etc., so tightly as to permanently injure them the first time they are used. A strong man can readily exert a pressure of 500 pounds to the square inch when the thread on valve stem is fine, and that kind of a man is as liable to put his weight on the feed valves of the lubricator, where the difference in gravity between oil and water need only be overcome as he is to use it on an injector.

In former years the "wide open throttle" theory was warmly advocated; of late, however, there has been less said in commendation of this practice. Except at very high speeds, it is not safe to say that the full throttle represents the maximum of economy. This is accounted for by the fact that a moderate throttle opening will tend to throw less weight on the unbalanced portion of the valves, and the wire drawing at the dome tends to superheat the steam passing down to the cylinders, resulting in a smaller loss by cylinder condensation. In addition, the writer submits as a farther reason that the limited steam space of the locomotive boiler suffers from the intermittent draft made on the steam supply, this irregularity being caused by the alternate opening and closing of the steam ports to cylinders as controlled by the valves, creating a pulsative movement that tends to the carrying over with the steam the injurious surface scum of water before mentioned. By limiting the draft at the throttle valve, this irregular demand is neutralized by the long dry pipe, and the current of steam flowing through the throttle valve is a steady and continuous one.

The keeping in proper condition of all oil cups, as well as the waste used for sponging tops of driving boxes, and the packing in cellars, will tend toward a reduction of trouble caused by heating of bearings.

In cold weather, when it is necessary to thin engine oil, use kerosene; while it is not a lubricant, it will thin engine oil as well as signal oil, and does not cost one-fourth as much. There is too much signal oil used for this purpose, its cost being greater than that of the best quality of engine oil. An unfortunate lack of knowledge in regard to the cost of supplies, leads to a waste that might be avoided if the information was at hand. For instance, an air hose for a car or engine costs $2.00; when bursted the head and trimmings can be fitted with a new piece of hose at a cost of 80 cents. Save $1.20 by taking in the disabled hose.

Engine and trainmen are very careful of white lantern globes that cost 8 2-3 cents each, while indifferent to the fate of red ones that cost 53 cents each. An automatic coupler costs about $9.00; a link, at the present extremely low price of iron, about 18 cents, a pin about 12 cents. Steps should be taken to inform engine and trainmen in regard to some line of conduct that would make these savings possible.

Excessive yard delays as well as the killing of too much time on side tracks greatly discourage men who are energetic and ambitious; effort should be made by those responsible to move trains with such dispatch as is possible.

A great many enginemen pride themselves on their ability to meet any possible breakdown. What to do and what not to do, under a variety of different circumstances furnishes endless material for roundhouse discussion. The skillful engineer should be capable of meeting any reasonable emergency that may come, but unfortunately the matter of avoiding a breakdown when it is posible to do so, does not always receive the attention it should.

Taking it for granted that no man looks forward to accident in order to display his skill in blocking or disconnecting, it is still a fact that closer inspection, more careful handling, etc., will prevent much of the expense so incurred.

Air brake literature is so plentiful and cheap that no engineman need remain in the dark, as regards this important feature of railway mechanics. The air pump probably suffers as much from rough usage as any part of the engine; it is subject to numerous ailments, yet when well cared for, offers little trouble. Keep glands well packed, give steam end one drop of oil per minute, oil air cylinders through oil cups, with a small amount of valve oil, when they seem to show need of oil by slightly groaning, use the throttle carefully and the pump will seldom fail.

After standing idle for hours, the cylinder filled with water by condensation, the pump is often started so suddenly as to do serious damage to its delicate valve gear. Start pumps very gradually, when pressure runs up set throttle just wide enough to supply train with air, adding a fair margin for such contingencies as falling steam pressure, etc.

It is possible with careful handling to us an air pump from shopping to shopping without calling in the services of the air-brakeman, and this with no other care than that just mentioned. Enginemen should strive to make trains stop easily and as quietly as possible. It is safe to say that the actual, though not always apparent, damage done by a rough application of the air brakes on a train partially equipped often exceeds the sum of $5.00. It is a mistake to think that everything is all right because couplings are left intact, and all wheels are on the track. To this end trainmen should co-operate as fully as possible with enginemen, and when doing station work be careful to make signals distinct and reliable. A great many accidents occur at stations by reason of trains parting back of air; this might often be avoided, if enginemen would train themselves to look back before beginning to stop train with air brakes.

With all that has been said and written in regard to the handling of locomotives, the greatest advancement must come through the medium of that personal interest that every engineman should take who is desirous of increasing his mechanical ability. The intelligent discussion of such subjects as the columns of the various railway publications suggest, as well as the daily happenings that occur to the men on any division, constantly improve those who participate.

The encouragement of local officials toward these discussions furnishes a stimulus which invariably insures their success, and which if withheld too often foredooms them to failure.

In this day of close figuring, the ablest man must and will come to the front.

The Composite Brake Shoe Company are out with a neat little reminder of the fact that they are doing business, in a tastefully gotten up presentation of their claims to recognition in the field of the brake-shoe trade. A summary of brake-shoe tests, copied from the table of averages of the Master Car Builders' Association report of 1895, shows their product with the cork filling in a very favorable light, showing an average coefficient of friction about equal to that of the soft cast-iron shoe. The composite people say this can be done, and at the same time their filled shoe will have the wearing endurance of the hard cast iron. The Sessions Foundry Company, of Bristol, Conn., have shown good judgment in simply stating facts in their 3½ x 5¼-inch pamphlet.

The Boston & Albany people are experimenting with a system of electric lighting of cars in which a dynamo mounted on one of the axles generates electricity that lights the lamps when the train is in motion. A storage battery keeps the lights shining when the dynamo is at rest.

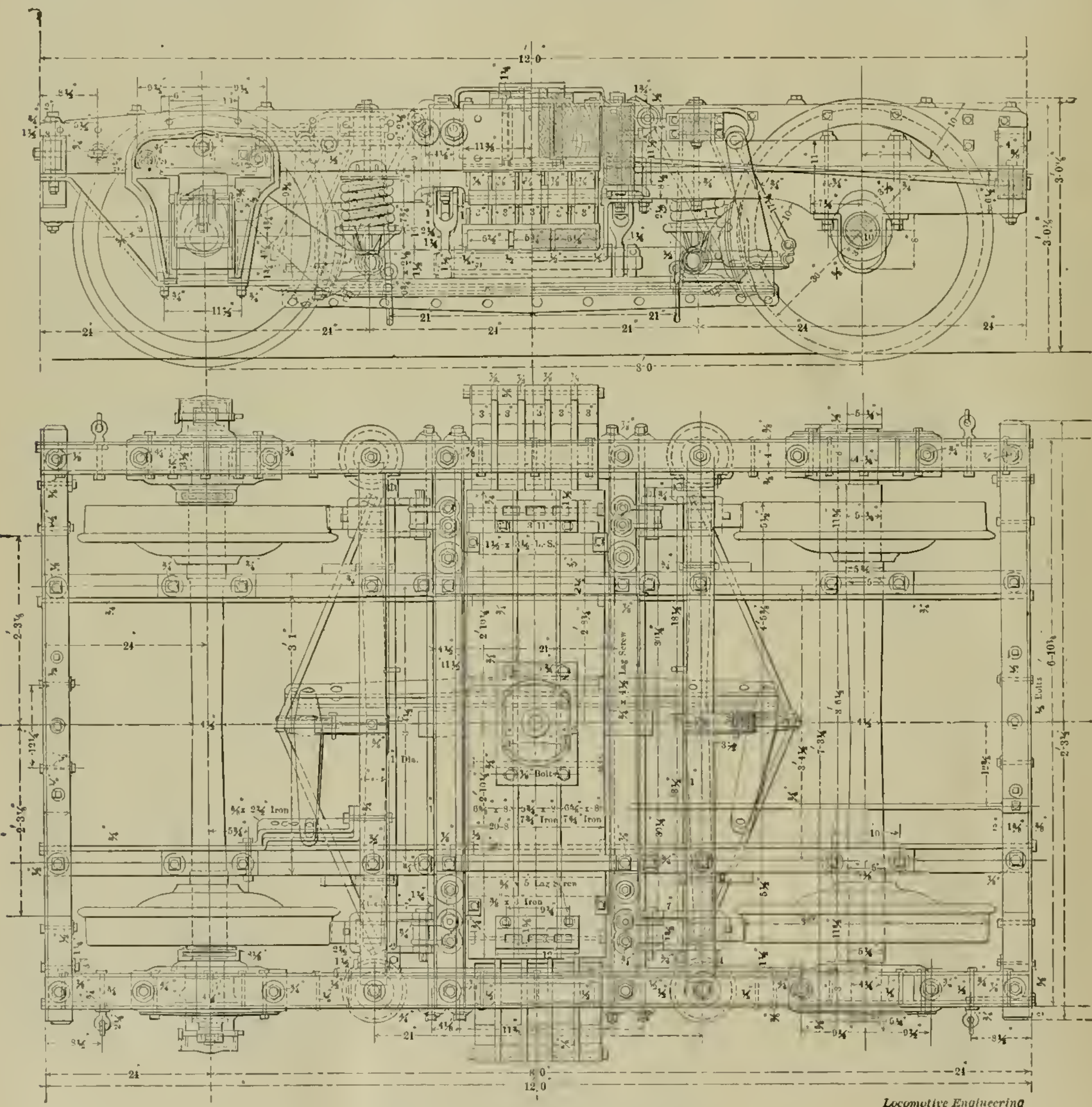
Car Department.

CONDUCTED BY O. H. REYNOLDS.

Erie Four-Wheeled Passenger Truck.

The standard four-wheeled truck herewith, shows the improved brake rigging as applied by Superintendent of Motive Power Mitchell in harmony with the recommendation of Mr. R. A. Parke, who later read his paper before the New York Railroad Club, on "The Effect of Brake Beam Hanging Upon Brake Efficiency," in which it was shown mathematically, and by actual trial figures, that the highest efficiency in braking is to be had only by suspending the brake beams from the truck frame and between the wheels; the length of hangers and connection of same to center of brake shoes, as well as the inclination of hangers, to be considered as the important factors in designing the brake gear.

This truck has a brake rig designed on those lines, and as a result has a braking power of nearly 97 per cent. of weight of the car, which gives a greatly increased efficiency over the old style of hanging. The wheel base of 8 feet gives ample clearance to allow of a correct design and adjustment of the beams and hangers. In all prominent essentials the truck is distinctively the evoluted product of the latest practice for passenger-car service, a composite in the truest sense, for the wheel pieces, transoms, bolster and spring plank are all of flitch plate or sandwiched



ERIE FOUR-WHEEL PASSENGER TRUCK.

construction, a form that has been made necessary by the increasing weight of passenger equipment in recent years. The dimensions in the illustration, which is, in fact, a working drawing, will afford a ready means of comparison with other four-wheel trucks, as well as to build from if desired. The exhibit is chiefly valuable as a record of the early adoption of an improved braking system as far as relates to its application to passenger-car trucks, a record which places this road among the first to adopt the means that insures smoother and safer work in braking, thus giving a practical endorsement to the finding of the highest air-brake authority in this country.

Composite Car on the Erie Railroad.

Our illustration of the steam motor car on the New Jersey & New York, a part of the Erie system, represents a type of car that is receiving attention from officials of roads operating branch lines whose business has been made to suffer by the encroachment of electrically propelled cars in the same territory, or whose travel is too light to insure revenue from regular passenger train service. This car is very similar to that of the New England Railroad shown in this paper last November, and was also built by the Schenectady Locomotive Works. The Erie, it will be remembered, was probably the first road to build and operate this style of car for suburban service, having built a car almost exactly identical with this over forty years ago. The picture explains the car, and the accompanying specification describes the engine, for both of which we are indebted to Mr. A. J. Pitkin, vice-president and general manager of the Schenectady Locomotive Works.

GENERAL DIMENSIONS.

Fuel—Anthracite coal.

Weight in working order, car and engine—114,800 pounds.

Weight on drivers—74,900 pounds.

Wheel base, driving—8 feet.

Wheel base, rigid—8 feet.

Diameter of cylinders—12 inches.

Stroke of piston—16 inches.

Horizontal thickness of piston—4½ inches.

Valve gear—Walschaert.

Kind of slide valves—American balanced.

Greatest travel of slide valves—4½ inches.

Outside lap of slide valves—¾ inch.

Diameter of driving wheels outside of tire—42 inches.

Driving box material—Steeled cast iron.

Boiler:

Style—Circular upright, with steam drum.

Outside diameter—Top, 63 inches; bottom, 52 inches.

ERIE COMPOSITE MOTOR CAR.

Working pressure—200 pounds.

Thickness of plates in barrel and outside of firebox—½, 9-16 and 11-16 inch.

Horizontal seams—Double, with welt inside, quadruple riveted.

Circumferential seams—Single riveted.

Firebox, diameter—45⅜ inches.

Firebox, depth—47½ inches.

Firebox plates, thickness—Sides, 5-16 inch; tube sheet, ½ inch.

Firebox, water space—3 to 3½ inches all around.

Firebox, staybolts—Taylor iron, 1 inch diameter.

Tubes, number of—318.

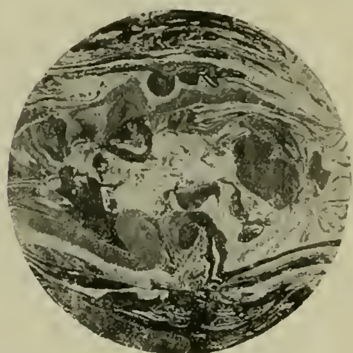
Tubes, diameter—1¼ inches.

Tubes, length over tube sheets—About 4 feet 8½ inches.

Heating surface, tubes—589.6 square feet.

Heating surface, firebox—53.3 square feet.

Heating surface, total—642.9 square feet.



ETCHING OF IRON AXLE.

Smokestack top above rail—14 feet 10 inches.

Boiler supplied by two Sellers class "N" improved injectors.

Water capacity—Twin tanks under body of car—700 U. S. gallons each.

Engine equipped with one 16-inch star headlight, magnesia sectional covering on boiler, two 2½-inch Crosby side outlet safety valves, Westinghouse automatic air brake on drivers and car truck; one Gollmar bell ringer.

An Object Lesson in Iron Axles.

The etchings shown in this connection are from Master Mechanic John Bean, of the Cleveland, Canton & Southern Railroad, taken from two car axles which recently failed on his line. Their structure is so plainly shown that comment can add nothing to the story of the weakness they tell. Etchings serve an admirable purpose in dragging to light the lack of homogeneity of metal, and had this test been put to coupons cut from the forgings, there is a strong probability that they never would have been turned and mounted. If iron axles must be used, it is plain that proper precaution should be taken to know that they are not like these examples of bad working.

A Special Air Drive.

One of the latest uses of one of the many valuable little air motors now so indispensable in railroad work, which has come to our notice, was that of driving a pipe threading machine, as arranged by Master Mechanic Barhydt, of the Buffalo, Rochester & Pittsburgh, at the Rochester shops.

It was in the case of piping freight cars for air that the motor was brought into a new use in machine driving, so as to cut the pipe on the spot where needed and save handling. The motor in this instance is a double oscillating engine, 3 x 3 inches, which was secured to the frame of the pipe threading machine by a suitable bracket, and the arrangement then taken to the yard where the piping job was under way.

Connection to the yard air plant completed a most desirable and satisfactory combination of motor and machine, since it was possible to carry it to any point and set it at work at once.

A very exhaustive circular of inquiry has been sent out by the committee of the Traveling Engineers' Association assigned to investigate the subject of lubrication of locomotives. Twenty-six questions are asked which are calculated for answer fully to supply information covering the whole subject. The chairman of the committee, to whom answers should be sent, is Mr. P. H. Stack, 1807 Seventh avenue, Council Bluffs, Ia.

The Wabash Railroad management have appointed a fuel inspector who has charge of all men and engines on the system so far as influencing the consumption of fuel is concerned. This official has issued a circular which reads: " An individual account."

Harassing Inventions.

My recollection of the ever-increasing stream of inventions intended for railroad purposes, leads me to believe that there have been succeeding periods when the invention of certain appliances was in fashion. My earliest recollection was the inventing of smoke-preventing fireboxes. Then came feed-water heaters. Both these lines of invention were epidemic for a few years. The monotony of Patent Office reports in those days was slightly varied by improved reversing gears, fastenings for tires and piston packing. That was on the other side.

I had scarcely begun to notice railroad things in this country, when I was impressed with the tremendous energy, fertility and resourcefulness of car-coupler inventors. That impression has not yet had time to abate. The old generations are mostly dead, but their successors are still hustling. Then came the inventing of spark-arresting smokestacks. But I shall not pursue the painful subject.

Speaking of smokestacks and other patent spark arresters, I think more grief has been imposed upon enginemen through that line of invention than through all others put together. Not a few railroad officials became rich from the royalty paid on patented smokestacks that were utterly worthless and were forced into use merely by the influence of the patentee. A stack that was largely applied on Western railroads to be quickly consigned to the scrap heap, was called by trainmen the ice freezer. No heat appeared to reach it.

I knew of a master mechanic who invented a brand new spark-arresting smokestack, and his friends assured him that he had struck something better than a gold mine. No matter how absurd things may be invented by a railroad officer, he will find a lot of toadies ready to praise it.

This stack was applied to an engine run by Joe Deitz, a droll Dutchman, who had a short run that took him away about six hours. When he returned, the master mechanic and a few admirers were waiting at the turn-table to hear Joe's report of the stack.

"Well, Joe," asked the master mechanic, "how did the stack go?"

"Co?" called out Joe. "Vy, Mr. Vilson, he vent youst so fast as der enshine."

"But how did it work, Joe?"

"Vell, Mr. Vilson, he vork peautiful; but dere vas von liddle change I vant you to make."

"What is that, Joe?"

"Vell, Mr. Vilson, you see that der traft vas all town dot stack, and I like you vould yust durn it uppside town."

Railroad officers are frequently too modest to criticise inventions brought to their notice, and some of them are kind enough to recommend the man with the patent model under his arm to go and ask the editors of certain railroad papers for their opinions about it. I have been generously treated in this way, and have received offers of interest in numerous inventions for the small consideration of paying the expense of putting them upon the market.

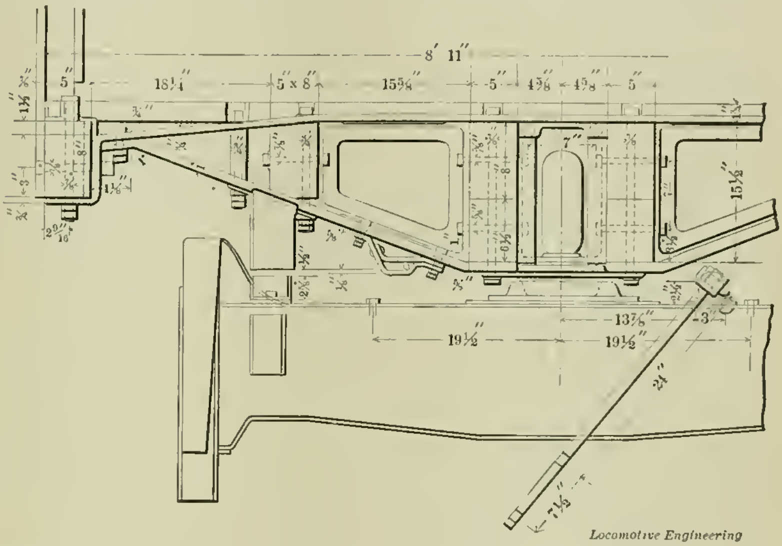
I shall close by relating a small incident connected with the examining of patented appliances. One time when the epidemic of inventing car couplers was at its hight, a gaunt-looking individual, whose appearance indicated an agriculturist out of luck, called at my office in the company of an ancient carpet bag. A curious thing connected with the inventing of car couplers is the large proportion of patents taken out by farmers and other people engaged in rural occupations.

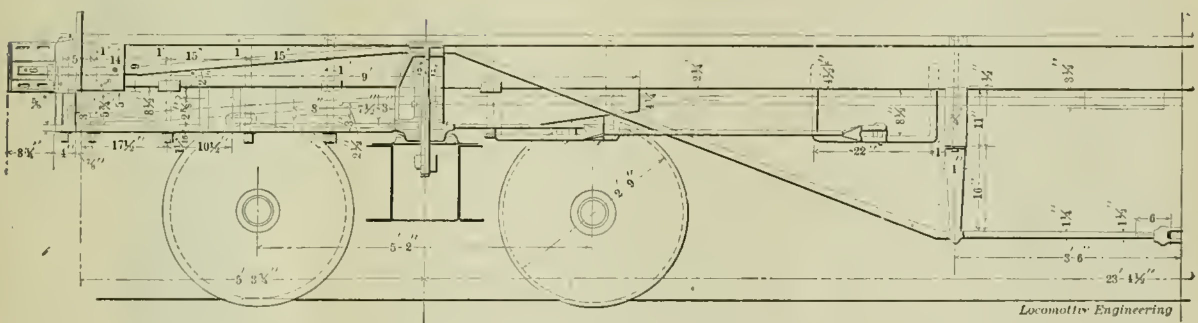
My rustic visitor intimated that he had been sent by a master mechanic of my acquaintance to get my advice about "a little invention he had been working upon."

"Take it out," said I, "and put it together. He drew from the bag a lot of wooden pieces worked into shape by a jack-knife, and proceeded to put them together upon the floor. When he had finished, I gazed at the apparatus, trying to make out in what way it was going to connect two cars together.

After considering it in all its bearings, I said. "Well, friend, I do not see how you expect that thing to work; but one thing, you have done that deserves mention—you have made the most extraordinary car coupler I ever saw."

The man looked up meekly, in a startled sort of way, and said, "Why, that's not a car coupler; that's a potato digger."—Extract from lecture by Angus Sinclair, on "Reminiscences of a Railroad Engineer."





SOME DETAILS OF 65,000-POUND BOX CAR.

Some Details of a 65,000-lb. Box Car.

The Buffalo, Rochester & Pittsburgh Railway has for a time had some new 65,000-pound capacity box cars of wooden type in service, that are worthy of mention on the score of excellence of design for cars of the kind, which means literally a rigid adherence to the matter of strength coupled with lightness. Superintendent of Motive Power Turner informs us that their light weight is only 31,000 pounds, which is a reasonable figure for a car of its capacity, 34 feet long and 8 feet 11 inches wide outside of sills.

Our illustration of the body of these cars is confined to the arrangement of truss rods and body bolster, as they are the parts by which the strength of the body is gaged, thus allowing a very light superstructure to be used, the details of which are, in general, similar to well-established practice, except in their curtailed dimensions to secure lightness of parts. The depth of truss at the cross-ties is one of unusual drop, and attention is invited to it; 34½ inches are the figures for the distance at that point, and in view of the fact that a sufficient depth there to properly take advantage of its benefits in a reduced fiber stress on the rods is so rarely found, this instance stands out as an example of practice to be commended.

In the body bolster is seen a design that shows by its center depth an ability to stand up and preserve its alignment against full capacity loads of the car. The distance of 17¼ inches over the upper and lower members of the bolster at the center, is one quite scarce in car bolsters, and is therefore remarkable as another instance of head work pitted aginst guessing, on a detail notoriously weak in so many cases, as to be the rule rather than the exception. Malleable iron castings are used exclusively throughout the car, and have a place as stiffeners between the bolster plates; the casting between the center sills serving as a support for the two central truss rods which are thus made to deposit their load on the center plates, and therefore have no tendency to deflect the bolster; the two outer rods only being in a position to get in a bending moment. An examination of the drawing will make it plain that the location of two truss rods at the origin of moments is a logical scheme for a weak bolster and the correct thing for a strong one.

The Baltimore & Ohio Railroad Company has improved its freight facilities in Philadelphia very materially during the past year. A new pier, No. 22 South, which was completed in December, is 557 feet long and 140 feet wide, and is said to be one of the finest in the city. Vessels of the deepest draught can tie up on both sides of the pier, thereby affording every facility for the prompt handling of freight. The pier and sheds are lighted with improved incandescent lights, and well paved driveways have been provided.

Electric Distribution of Shop Power.

At the March meeting of this club, a paper on "Electric Distribution of Shop Power" was read by Mr. George Gibbs, embracing some valuable information on this subject, and bringing prominently into view the losses in power to overcome friction in belting and shafting between the engine and machine countershaft. Under the head of economy in shafting transmission, figures were given to show what was found in heavy machine drives in railroad shops. The friction horse-power required to drive belts and shafting was that referring to the electric distribution of power at the Baldwin Locomotive Works, with a table containing an abbreviated list of tools operated by individual motors, with the amount of electric power supplied the motors with no load, a light load and a full load. The machines tabulated are widely in use in railroad shops, and the table is appended as an interesting and valuable contribu tion to information not readily available to the average shop manager, as to the power consumed by the tools mentioned in the annexed table:

Tool.	Kind of Work.	Cut	H. P. Required. Empty.	Light Load.	Full Load.	No. of Cutters.
70 Wheel Lathe ..	Wheel Centre.	Light.	....	4 4	7.9	2
	32" Wheel Centre.	½" Deep.	....	4.7	5.8	2
	56" Wheel Centre.	......	1.5	5.2	6.2	2
Horizontal Lathe...	56" Wheel Centre.	⅙" Deep.	....	4.3	7.1	1
Slotter 18" Stroke...	Frames.	Heavy.	2.3	5.0	10 3	1
Large Double Frame Planer	2 Frames.	½" Deep.	11	....	21.6	2
Slotter 12" Stroke...	Wrought Iron 6" Thick.	......	1.5	2.1	6.5	1
36" Planer..........	Frames.	......	3.4	4.2	7.4	1
	Frames.	.....	3.4	..	11.3	2
Drill Press	1" Drill, Wrought Iron.	.....	.97	1.94	2 9	1
	1½" Drill.	......	.97	1.92	2.2	1
	2¼" Drill.	......	.97	1.94	2.85	1
Boiler Plate Shears..	9-16" Plate Steel.	......	3.5	6.	19.	1
Boiler Plate Rolls...	Steel Plate, 11 16" Thick x 10'-6" Long in Shears.	.....	4.5	14.4	19.8	..

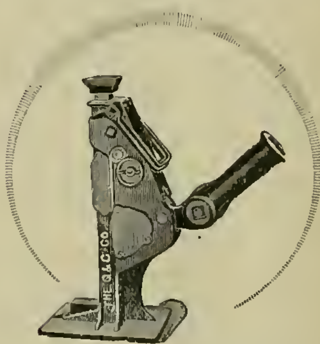
from engine pulley to machine pulley was shown to average, for a number of shops, 52 per cent. of the total power used.

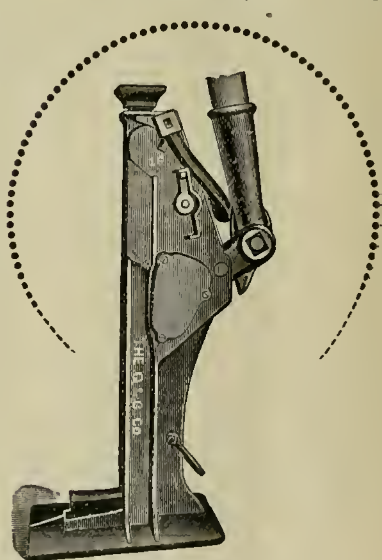
The resistance to overcome between engine and machine for shafting and belting in a planing mill was given in one case as 63 per cent. of the total power, and in another case which was investigated by the author of the paper, considerably more; the latter instance being the planing mill of the Chicago, Milwaukee & St. Paul Railway, at Milwaukee, which required an expenditure of 500 indicated horse-power to drive the loaded mill, and 375 horse-power for the shafting and belts when the machines were not operated—exactly 75 per cent. of the total power required to drive the plant. Other data taken from information in this line compiled by Prof. Benjamin, gives friction horse-power per 100 feet of shafting as averaging 5.57; useful horse-power per machine averaging 0.45, with a wide range of variation, from 0.7 to 0.16 horse-power; useful horse-power per man averaging 0.38, and varying from 0.88 to 0.14 horse-power.

Following this data on expenditure of power by belts and shafting was a description of electric transmission systems, with hints as to arrangement for special cases, and cost per horse-power for motors. The most interesting portion of the paper, perhaps, to the railroad contingent

The cars for the two new express trains for the Chicago, Milwaukee & St. Paul Railroad, being built by the Barney & Smith Car Company, will be equipped with the two-coil jointless steel, fireproof Baker heater. Mr. Baker also reports that he has just furnished twenty-eight single-coil fireproofs for the Great Northern Railroad's new cars, building at Barney & Smith Company's. Louisville & Nashville, Missouri Pacific Railways and Pennsylvania lines have also been liberal buyers of his fireproof heaters during the last few months.

The Davis & Egan Machine Tool Company, of Cincinnati, O., have just received, through their office at Berlin, Germany, orders from the "Gewerkschaft Deutscher Kaiser," at Bruckhausen (Rheinisch Prussia), for fourteen machines, including lathes, planers, shapers and drill presses. This is the largest steel works in Germany. They have also received, through the same office, an order from the "Inter-Nationale Bour-Gesellschaft" for twelve lathes and twelve drill presses. The company is now running its Cincinnati plants day and night, and the plant which they recently purchased in Covington, just across the river, will be in full operation within the next two weeks.





Discussing Questions of Signaling.

The Railway Signaling Club held a meeting at Pittsburgh last month, and discussed a variety of subjects relating to signaling. The most important paper was on "The operation and maintenance of a block system on a single-track railroad, as used on the C. N. O. & T. P. R. R.," written by Mr. W. A. D. Short, was read and discussed. The principal points brought out in the paper and discussed were:

Questioning rule 4, which requires that "Trains of an inferior right approaching a meeting point within the limits of a block, may pass the red signal and proceed to the siding when under full control." By decision of the majority of the members, it was decided that signals should be re-located, so that this rule would not be required, it being a bad plan to have trains run by a signal, under any circumstances, when at danger.

The point in regard to the rule requiring the engineer to observe the signal change to danger before he passed it was fully discussed. The sense of the meeting in this regard was, that with the automatic signals in use to-day this was an unnecessary precaution, and that full confidence should be placed in the proper working of the signals; that the disadvantages of requiring the engineer to stop balanced the protection to be afforded by his using caution in going through the block, so that it was very doubtful if there was not more danger in taking the indication as a danger signal in place of the clear signal.

Mr. G. W. Rhodes at Purdue.

Mr. Godfrey W. Rhodes, superintendent of motive power of the C., B. & Q., delivered an address before the engineering students of Purdue University, on February 19th, upon "Experiences in the Motive Power Departments of Railways." Not many men have enjoyed a wider experience than that which has been had by Mr. Rhodes, and few have observed more carefully. His lecture, while dealing with incidents, was full of serious suggestions.

He first discussed the fundamental principles which apply in the management of men, and urged the value of painstaking and considerate attention on the part of heads of departments, sketching briefly some of his personal experiences, and leading his audience to a broad view of the responsibilities resting upon those who are called to direct the work of others.

The dependence of practice upon the application of correct principles was illustrated by a convincing discussion concerning the defect of a detail of a locomotive, which had long been standard on a leading road, and which, though parts were repeatedly increased in size, could not be held together until the general design was corrected.

He presented in a charming manner the necessity for conducting experimental investigations under conditions of actual service, and illustrated his point by showing a switch lens, which when tested by sunlight, as is often done, was blue, but which when illuminated by the yellow light of a candle, quickly became green; also by exhibiting two red glasses which were of entirely different shades under sunlight, but practically the same when illuminated by yellow light—that is, under conditions common to practice.

The value of experimental research was illustrated by a brief account of the Burlington brake tests, and the modesty with which the speaker referred to the difficulties encountered, and of the far-reaching effect of the results obtained, aroused but slight suspicion in the minds of the student audience, that he was the masterful leader in that great work.

The book department of Locomotive Engineering has met with a great increase of business lately, and we have been compelled to get out a new edition of our "Book of Books," which is the catalog of the most popular engineering books which we handle. Send for it.

The little book called "Practical Shop Talks," by Fred H. Colvin, which we have just put upon the market will be much prized by all classes of people interested in mechanical matters and who admire common-sense ways of doing business. If we wished to stimulate the ambition of an apprentice or young shop man, we do not know of anything better than inducing him to read "Practical Shop Talks." The youth who could read the book without being stirred to help himself is not worth helping. The price of the book is 50 cents.

The Panama Railroad Company are looking for a master mechanic to take the place of the late D. G. Mott, who was accidentally drowned several months ago. The company offer to pay $225 a month in gold, and grant the privilege, after ten months' service, of two months' leave of absence; one month at full pay, the other at half pay. Parties willing to accept this position would do well to communicate with this office.

We have within the month received a number of applications from railroad companies and others for good draftsmen accustomed to railroad work. If any good draftsmen are looking for positions, we should be glad to hear from them. Master mechanics and general foremen who are looking for positions would do well to send in their names, as we frequently have inquiries for such officials.

Breaking of Eccentric Strap Bolts.

Some trouble has been caused on the Chicago, Burlington & Quincy Railroad by the breaking of eccentric-strap bolts on the heavy engines in fast service. The straps in which the breakage occurred were like Fig. 1, and the bolts were increased from 7/8 inch to 1 1/8 inches diameter, with the idea that more area of metal would meet the difficulty. These bolts are seen to be in both tension and shear. A change of strap to the shape shown in Fig. 2, where the bolts were subjected to tension only, effected a complete cure, with 7/8-inch bolts. The design of strap, Fig. 1, was one of the common forms of strap construction several years ago, and quite generally used when boiler pressures were lower than they are now. They furnish a good illustration of the effect of position on resistance of parts to stresses.

receiving and shipping departments extensively. In the power house, new engines, dynamos, etc., are about to be installed. They now have a capacity of about 1,000 tons a month, which will, of course, be greatly increased by the changes now in process.

The Cincinnati, Hamilton & Dayton, who have been devoting a great deal of attention to the economical operation of suburban passenger traffic, have recently received from the Baldwin Locomotive Works a steam motor car, capable of carrying twenty-four persons. A peculiarity about the car is that it has a condenser in the roof, where the exhaust steam is condensed and returned to the boiler. The car was tested on the tracks of the Philadelphia & Reading, and in addition to its own weight pulled a box car loaded with oats a distance of 38 miles at speeds varying from 30 to 40 miles an hour. The fire required no attention, and received none during the entire run of 38 miles.

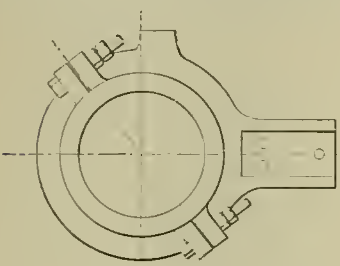


Fig. 1

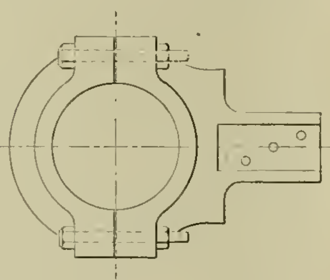


Fig. 2

TO STOP BREAKAGE OF ECCENTRIC STRAP BOLTS.

A Flue Sheet Cutter.

A very handy device for cutting out flue sheets has been put on the market by Ott. Mergenthaler & Co., of Baltimore, Md. It is a very simple device, uses commercial bar steel for cutters, and ought to be enonomical in many ways. Strength and durability have evidently been carefully considered, and up-to-date boiler-shop men will want to know more about it.

In taking water on the fly, going from Harrisburg one day last month, the engine attached to the St. Louis express threw water over the front end of the baggage car and the liquid froze. The train was delayed in Altoona station about forty minutes to pry the door open and put the Altoona baggage out.

The heavy business so far this year—showing, in fact, an increase of something like 40 per cent. over business for corresponding period in 1897—has made it imperative for the Sargent Company to considerably increase their capacity, and to that end they have recently installed a large 20-ton electric traveling crane from Manning, Maxwell & Moore, in addition to the cranes now operated, and an additional saw of the latest and most improved type manufactured by the Q. & C. Company, and rearranging their

William Dinwiddie, the eminent photographer, of Washington, who has been taking a series of views, both scenic and industrial, for the Baltimore & Ohio Railroad, has completed the outdoor work, and is now engaged in making proofs of the 800 or more negatives that he secured during the summer and fall. About one-third of this work has been completed, and photographic experts who have examined it pronounce it the finest collection of its kind that has ever been taken. One of Mr. Dinwiddie's scenic B. & O. views has received honorable mention in the Salon at the Carnegie photographic exhibit in Pittsburg.

The New York Central Railroad Company are making extensive changes on the Grand Central station at New York. To increase the office accommodation they are putting two extra stories on top of the portion devoted to offices. The latest joke of the day is, that the New York Central are making the changes on their station to give Chauncey M. Depew two more stories.

Running Compounds on the P., X. & Q.

R. E. MARKS.

The P., X. & Q. have had a small lot of compounds in service for the past few months, and if there's anything that brings out the character of the men, it's a lot of new engines, whether they are compounds or Gilderflukes.

They put four of them on John Dusenbury's division, and John had a quiet talk with the men and the traveling engineer, and the compounds gave good satisfaction from the start.

On the next division the compounds raised Cain generally, and the division superintendent was ready to condemn the whole lot as being peace disturbers, and no earthly use anyway. The general manager was troubled, but he dropped off the train to see Duzenbury one day, and see what he thought about it. He had heard of John's red smokestack business, and thought better of John in consequence; but he kept this to himself.

"How are the compounds, John?" was his greeting. When the general manager thought compounds he couldn't talk anything else—wasn't what they call diplomatic a bit.

"First rate," said John. "They're taking their regular trains over the division every day on time, and not a word of fault with 'em either. The men like them on account of the coal premiums they give 'em. Some of the men drew $15 last month."

"Too much money," said the G. M., thinking about dollars instead of compounds for a minute.

"Don't exactly agree with you in that, Mr. Brewster. Just think it over a minute. We divide the saving between the company and the men, then the engineer and fireman divide their half between them. If each of them draw $15 or both draw $30, it means they have saved $60 worth of coal over old practice. Out of this the company get $30 clear gain over the amount of coal allowed the men for their runs. But you asked about compounds, Mr. Brewster."

"Yes, that's it, John—compounds. I've just been over on Jack Hughes' division and he had a tale of woe as long as a Methodist deacon's face. Compounds wouldn't steam, wouldn't start a train, lost time and raised h——, I mean Cain, generally. Said you must have some different engines from his, when I told him you hadn't registered a single kick and hadn't had any trains late that I knew of. How do you explain it, John?"

"Don't," said John; "but if you'll send four of Jack Hughes' engines over here next week, I'll give him my four, and see where the difference is. Come around next month, Mr. Brewster, and I may have a different story to tell."

"Say, John, are you any relation to Skinny Skeevers I've read about; this seems like one of his gol durn—er—I mean confounded object-lessons."

"Don't know Skeevers; wish I did," said Duzenbury, "might get some points on the compounds and other things."

About a month passed, and Mr. Brewster appeared again, and just as he dropped off the train by Duzenbury's office, one of the compounds pulled up past on the main line, hauling her regular train and making schedule time without a whimper.

"Well, John, they're running, I see; how are they doing, anyhow?"

"Fine. Even a little better than the others, if anything. What are my old ones doing for Jack Hughes?"

"Raising the deuce with him, same as these did. Says every man on his division has lost what little chance they ever had of salvation, swearing at those blankety-blank engines. Says if you or anybody else say they run all right, you must be a twin brother to Ananias. His men are down on 'em and so is Jack. He's a good man, and has always done well, and I'll be jiggered if I know what to do about it. What do you s'pose is the reason anyhow?"

"Well, if I was general manager, I'd find out P. D. Q., or sooner, why an engine would do well on one division (supposing, of course, that I didn't lie to you when I said they did) and wouldn't do at all on the next division. I don't want to do any boasting; but if I was in Jack Hughes' place, those engines would go. How do I know? Because I had the same racket he had for the first week. The engines wouldn't steam, make time or anything else a well regulated engine ought to do. I knew they had run on other roads, and there was no reason they couldn't here. So when a man kicked or came in late, I called him to the office and had a little quiet chat with him. I told him the compounds had come to stay, and were going to stay, and if he wanted to stay, too, he must do good work with the engines. Told him that if he handled 'em right and used the same horse-sense he did on his other engines, he wouldn't have any trouble.

"Some of the boys got mad, and wanted to know if I thought they didn't know how to handle an engine right; but I just said to them that there was a difference between knowing and doing. Told 'em they knew enough, but the trouble was they wouldn't do it; that they were prejudiced against the engines, and the sooner they got over that the better, for if they couldn't run them somebody else could. You see the result. If Jack Hughes hadn't let the men make him believe they wouldn't run, he'd have done the same thing, and everything would have been 'O. K.' That's the only remedy I know of, Mr. Brewster, and if you'll send some of Hughes' men down here, or let my traveling engineer go up there, with full authority, for a couple of weeks, there won't be any more trouble."

"Well, I'll be jiggered," said the G. M.

to himself; "I wouldn't have thought that Duzenbury had so much sand or Jack Hughes so little."

P. S.—Compounds "go" on any division now.

The Coffin Toughening Process.

Under the above title, Mr. L. R. Pomeroy, the New York sales agent of the Cambria Iron Company, read an interesting paper before the Western Railway Club at the February meeting. The object of the paper was to make plain the effects on the ultimate strength and elasticity of steel when subjected to the toughening process. The crystalline structure of the material before and after the process was admirably illustrated by means of etched sections, showing the effect of varying methods of cooling at different temperatures. Our space at this time will not allow of such a review of the paper as it deserves, but the advantages of the process were summed up as follows:

"1st. All the irregularities of forging are relieved and the steel brought from an irregular and coarse crystalline to an amorphous state. 2d. The elastic limit of the steel is greatly increased without the loss of elongation or ductility, as shown by the following test: An axle was cut in two, one-half of it alone being toughened. A tensile test piece, 4 inches long between fillets and ½ inch in diameter, was cut from each half, giving the following results:

	Elastic Limit, Pounds.	Ultimate Strength, Pounds.	Elongation. Per cent.	Reduction. Per cent.
Untoughened	30,000	71,520	24 50	51.50
Toughened	44,000	72,020	24.07	57.20

From the above table it is seen that the test pieces show the same properties in all respects, except in the elastic limit, which is worthy of note: the toughened piece being 46.6 per cent. higher than the other in that respect.

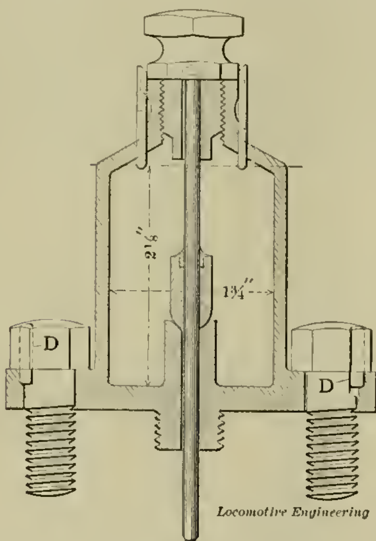
The International Correspondence Schools, Scranton, Pa., have issued a circular giving endorsements of the steam engineering course by eighty-eight students spread over nearly all the States of the Union, Canada and Mexico. If any of our readers are "standing on the brink," uncertain about stepping into the stream of knowledge flowing from this school, we would advise them to send for this endorsement pamphlet.

The record of the Nickel Plate Road during the recent period of industrial depression has been remarkable, and it speaks most eloquently of the conservative judgment of its managers. For this road has made great and steady progress in the material improvement of its roadway and transportation appliances, and in perfecting its equipment.

A New Rod Cup.

This cup has been given the name of "Bull Dog," from its holding-on qualities; one of its strong points being that it cannot lose itself or any part of it, without a smashup or the gentle persuasion of a sledge hammer. After the cup has been bolted down to strap, the small dowel pin *D* is driven home through hole in head of screw and cuts its way into the brass. The hole is then riveted over enough to prevent pin working out, fastening the cup securely to the strap.

There is no top section to lose, and



BULL DOG OIL CUP.

the feeding plug and feeder cannot jar loose.

The feeder works automatically, and is on the principle of a pump, the rod being moved at every revolution of the engine. The proper lift of the feed rod is determined by the makers, and the top of feeder rod is case-hardened to prevent being filed off or tampered with.

The cup is also made for solid end rods, and is made by the E. F. Gibbs Company, Cincinnati, O.

The Chicago, Burlington & Quincy have had considerable trouble from leaky staybolts on engines standing in their roundhouses with the stacks under the smoke jackets. On boilers, after dumping fires, the steam pressure dropped from 95 to 25 pounds pressure in three hours, owing to the cold air drawing through the jack stack flues and firebox. When a cover board is put on top of the stacks, the engines similarly situated as in the foregoing, the pressure dropped only from 65 to 50 pounds in three hours, and best of all, the leaking of the staybolts has stopped.

For about ten days last month M. Soulecroup, assistant superintendent of motive power of the Paris & Orleans Railroad, and a corps of five assistants inspected very closely the electrical plant of the Baltimore & Ohio Railroad, at Baltimore. The splendid work being done by the the electric motors in the Belt Line tunnel has attracted attention all through Europe, and M. Soulecroup's visit to this country was for the express purpose of investigating the ways and means of operation. The Paris & Orleans Railroad is to be an underground line running from one of the suburbs of Paris to the center of the city, and it is quite probable that it will be equipped with electric motors similar to those used in the Baltimore line, except that they will be much smaller.

We do not remember reading such strong endorsements by railroad officials as many of them have expressed concerning Brill Perfect Truck, No. 27. One general manager reports that on trial the performance of the truck was so satisfactory that they changed their entire equipment to use it alone. The testimonials published in a recent pamphlet show that the truck is very easy to maintain, sticks wonderfully well to the track under the most adverse circumstances, and makes the cars remarkably easy riding. Those interested ought to send for the pamphlet to J. G. Brill Company, Philadelphia.

Thirty-one thousand tons of steel rail, ranging in weight from 75 to 85 pounds to the yard, will be placed in the Baltimore & Ohio tracks this spring. It is expected that the work will begin by April 1st and be completed within three months. Twenty-one thousand tons will be laid east of the Ohio river, and forms part of the 40,000 tons purchased last summer, the balance being the 10,000-ton lot recently bought by the receivers for west of the Ohio river.

The American Machinist Publishing Company are sending out to their friends a small box containing ten draftsmen's thumb tacks, with the *American Machinist* coat of arms on the face. When stuck over a drawing, these thumb tacks give it a very artistic appearance. People who have use for thumb tacks can obtain a box free by applying to the *American Machinist*, 256 Broadway, New York.

During last month Angus Sinclair delivered a lecture on "Reminiscences of a Railroad Engineer," to the railroad branches of the Young Men's Christian Association connected with the Delaware, Lackawanna & Western, at Scranton, and with the New York Central, at Madison avenue, New York City. At both places the lecturer was heartily applauded.

The Ingersoll-Sergeant Drill Company, Havemeyer Building, New York, have issued a new illustrated catalog, showing their mining, tunneling and quarrying machinery. It is got out in excellent style and gives a great many valuable particulars about the industries it deals with. Anyone interested in that kind of work ought to send for the catalog.

"Friction and Lubrication" is the name of a small pamphlet recently issued by the Joseph Dixon Crucible Company, of Jersey City, N. J. It contains considerable interesting matter on the subject treated, and will be found a very valuable help for men who are trying to get a mile or two more to the pint of oil. It will be sent free on application.

The Boston Belting Company have recently issued an illustrated catalog, showing the various kinds of garden hose, nozzles, etc., handled by the company. It shows pictures of more things than we ever imagined were used in connection with the watering of gardens. Those interested in apparatus of this kind should send for the pamphlet.

In a proclamation issued by Governor Pingree, of Michigan, all people in the State are enjoined from accepting free passes on railroads. It also asks clergymen to stop accepting reduced rates on railroads. Free rides and reduced rates, the Governor alleges, rob the school children of a certain amount of tax on railroad earnings.

The Buffalo Forge Company have secured the contract for heating and ventilating the new State court house at Fort Wayne, Ind. This is a very large contract. The system to be used is the same that is in use in the Auditorium in Chicago, and in the new City Hall in St. Louis.

The committee on the supervision of standards and recommended practice of the Master Car Builders' Association are calling for suggestions in reference to any modifications of the established standards, and recommend the practices of the association are justified by experience in their use.

It is reported that the Chicago, Rock Island & Pacific people are about to equip their principal passenger engines with electric headlights.

Filling the Hole.

BY L. D. SHAFFNER.

Once on a time "Red" Parkinson was an engineer on the Butte & Anaconda. One night his fireman took sick and he had to start from Butte with a newly appointed coal heaver, who was promoted for the occasion. "Red" was known as a hard hitter, and he had a way of introducing himself to a new fireman that an experienced man did not relish. When the new man arrived at the engine, "Red" pointed to the firebox and said, "When that hole is full you are done."

I think this was the first time the new fireman ever looked into a firebox, and as "Red" immediatly went over to his side, he did not hear what the new man said. From Anaconda to Stuart is a nine miles down grade. As they ran all the way down the hill, the new fireman lost no time, but "merrily heaved away." As the boiler head was outside of the cab, "Red" never noticed the industry of his new man. Sailing into Stuart, he found a flag out, and had to stop for orders. As he was a long time in the office, our brave fireman had ample time to take "Red" at his word and get the hole full. When the engineer finally came out, he had a time order, and seeing the black smoke rolling and pointer standing at popping point, he said nothing, but began to pound the hog with a train of dumps out of town. He had not gotten far when he noticed the steam going back like a home-sick Klondiker, and upon looking across the boiler, lo! our frisky fireman was resting easily on the seat.

"We cannot both ride up here," said "Red," in a fighting voice.

"I can," replied the happy fireman; "the hole is full," and so it proved, as "Red," swearing softly to himself, found out on looking into the firebox.

"Red" was mad, but admitted that the laugh was on him, and made the statement that for once he could not take it out as fast as the boy could put it in; but added that he was badly handicapped that time. Two hours was the time consumed in digging it out, and poor "Red's" heart was nearly broken.

Missoula, Mont.

Stealing the Gilderfluke Fender.

A Minneapolis paper recently said: "James Robinson, a bright young colored man, who for twelve years has had charge of the Milwaukee private car at this place, is a happy man. He refused an offer of $15,000 for his invention, the locomotive life fender. It has been proven by engineers and practical men an excellent thing, and he expects to sell the right to make it to some large manufacturing establishment, reserving a royalty for himself."

We are informed that Mr. Robinson has applied for a patent on his invention, but we are a little doubtful about his succeeding, because it seems to be a very close imitation of the fender placed by Professor Gilderfluke in the front of his locomotive, which we illustrated in our December number. To be sure, the Robinson fender is one of the "lazy tong" sort of affairs that can be pushed out and drawn in at the will of the engineer, but it is for all practical purposes the same as the Gilderfluke fender.

Western Locomotives Competing.

Some time ago the Chicago, Burlington & Quincy and the Chicago, Milwaukee & St. Paul exchanged engines for trial on various passenger trains run by the different roads. We have received somewhat conflicting reports about the behavior and performance of the engines that were exchanged, and we did not publish any of the statements, because they seemed to be one sided. We have recently received a statement from a gentleman who visited the officials of both roads, and we think the facts of the case may now be stated as follows:

The first thing that was definitely proven was that each engine was the best for the particular service for which it was designed. The Q. engine ran away behind in competition with the C., M. & St. P. engine on the Milwaukee road, and the C., M. & St., P. engine consumed 4,500 pounds more coal in a run of 207 miles than the Q. engine on the latter road. The philosophy of the case is said to be this: The Q. engine was over loaded on the C., M. & St. P., and the C., M. & St. P. engine was under loaded on the Q. road; so the C., M. & St. P. men claim that if they had had a load nearer the capacity of their engine, they would have made much better showing on the C., B. & Q. tracks. This was proved on a certain division where there is a heavy grade. The Q. engine having a very large tank, kept on without stopping, and profited by the kinetic energy of the load and was able to maintain a speed of 55 miles an hour over a certain grade. Whereas the C., M. & St. P. locomotive, on account of having a small tank, had to stop for water and from a dead stop get up to the same speed on a grade. This showed the great reserve power of C., M. & St. P. engine, and had the Q. engine found it necessary to stop for water, it could not probably have gone over the grade at a speed above 25 or 30 miles an hour.

This leads now to a consideration of what the two types were designed for. First, the Q. engine, with 84¼-inch driving wheels and 1,580 square feet of heating surface, was built to haul a fast mail over a particular division which had comparatively light grades; while the C., M. & St. P. engine, with 78-inch drivers and 2,245 square feet of heating surface, was designed for a heavy train.

LOCOMOTIVE ENGINEERING
A PRACTICAL JOURNAL of RAILWAY MOTIVE POWER AND ROLLING STOCK.
[Trade-Mark Registered.]
Vol. XI. NEW YORK, MAY, 1898. No. 5.

New Caledonian "Infants."

The handsome passenger engine shown in the annexed engraving was recently designed by Mr. John F. McIntosh, locomotive superintendent of the Caledonian Railway of Scotland, and the class are fondly spoken of by railroad men as McIntosh's "infants." They are pretty big infants, being the largest passenger locomotives in Great Britain, and probably the equal, as fast train haulers, of any locomotives in Europe.

Mr. McIntosh attained celebrity a few years ago through what were known as the Dunalastair class of locomotives, that were his design. When put into service these engines proved the most powerful in the British Isles, and were able to haul trains that previously required the use of two engines. Mr. McIntosh evidently thought that he could still do a little better, and he proceeded to design the class of locomotives shown. Fifteen of these engines have been built, and they are reported to be doing admirable work.

The engines have cylinders 19 x 26 inches, driving wheels 78 inches, and have 1,500 square feet of heating surface. The tractive power is 16,840 pounds. The tenders are designed to carry 4,000 imperial gallons of water and they are carried on two pairs of trucks, a new departure for British practice.

LATEST CALEDONIAN EXPRESS LOCOMOTIVE.

General Master Mechanic Kearsley, of the New England, has put a 60-inch boiler on one of his 17 x 24 standard engines, and has set the pops at 185 pounds. The engine has a 63-inch wheel, and with the increased weight on it due to the larger boiler, there is no tendency to slip with the higher pressure carried, and the engine exerts about 20 per cent. more starting power than when it had the small boiler and low pressure. The old cylinders were used by shimming up the saddle with a light and tasty-looking casting under the smoke arch. This scheme of enlarging the boilers on old 17-inch power has proved beneficial in all cases coming under our observation.

There is considerable agitation going on in London regarding the ventilation of the underground roads. Coke has been tried as a fuel, but the gases are unbearable to the men, and Welsh coal has been adopted. Now there is demand for electricity or some other means of propulsion. The heat of the tunnel, due to escaping steam and gases, is said to largely reduce the traffic, and likewise the receipts, in the summer months. This is apparently a case where electricity or compressed air has many advantages over steam used direct.

A Locomotive in Chancery.

(CONTRIBUTED BY LODIAN, OF "UNDER HIS HAT.")

There is a great river dividing the western and central sections of the Great Cibirian (commonly corrupted "Siberian") Railroad—the river Ob. Now it has a fine half-mile bridge over which trains run, but at the epoch this photo was taken the bridge was not ready, so a temporary track was laid on the ice. It was January, 1896, but the ice was not thick enough on the passage of the first engine for a test. Yet the division engineer thought the ice would bear. The engine was getting on across the river, when there was a sudden and most uncomfortable sounding cracking, and the next instant down went the locomotive, but only for a few feet. Fortunately she did not leave the rails. The track bent and swayed, but remained true, and this prevented the engine going to the bottom. She remained suspended there in chancery until the afternoon, when a stout rope was harnessed round the tender, and she was hauled back over the rails to land. The view taken shows the engine about the middle of the river, which is here very wide—a vast expanse of frozen waste. Here and there on the ice is material for the great bridge.

This is the most unique railroad photo I have ever taken during my (equal to) four trips round the globe. I do not once recollect hearing before of a locomotive caught in this predicament. The negotiations for the possession of this photo lasted over twelve months, and, singularly and peculiarly enough, the expenses one way and another attendant thereon exceeded $200. Therefore it is probably the dearest railroad photo ever handled.

The 8,000-mile walking inspection of the Great Cibirian and Russian railroad system has been definitely concluded; time, 1 year 10 months 1 week (of which nearly half the time not walked—resting and inspecting here and there). The walk was guarded secret throughout. The *pechkom* (Russian for walk) was entirely scientific. Some 20 million ties were walked over; 3,000 miles walked over the snow and ice, 52 degrees below zero (Réaumur); walked through four mountain ranges, crossed afoot, and not a single mishap or molestation during the entire journey. About 200 Russian engineers were interviewed and also two Russian Ministers of State.

In reply to inquiries, the total expenses of the walk were a little over $3,000 (6,000 roubles. Cibiria and Russia are the dearest places on God's foot-stool in which to live, and even this sum represents economy *a la* Scot.

LOCOMOTIVE CROSSING RIVER ON ICE.

The Baltimore & Ohio have recently given an order to the Racine Fire Engine Company for $56,000 worth of chemical fire-fighting machinery—a very sensible investment.

Boston's New Union Station.

The mammoth Union Station in process of erection for the roads entering the city of Boston on the south side, is assuming such a tangible form, that some idea may now be gathered of the immensity of its proportions when completed. It is designed to care for the passenger business of the New England, the Boston & Albany and the New York, New Haven & Hartford roads, and will be the largest passenger station in the world, with its length of 700 feet, width of 600 feet and hight of 106 feet.

There will be twenty-eight tracks on the ordinary level for through trains, but the disposition of these tracks is still an open question. The arrangement of tracks for suburban service will possess some marked innovations, the most important of which will be the manner of arrival and departure of these trains at a level below that occupied by the main-line trains. The suburban trains will enter upon two tracks, and, passing around a loop, depart headed in the right direction without any switching or making-up of the trains, heading in and heading out. This implies either compressed air or electricity for motive power.

From that portion of the stone enclosure now up, the architecture is seen to be of a massive and imposing order, the buttressed walls having an air of stability that is entirely absent in the steel-framed structures that are simply veneered with brick or stone. Recent observations of the progress made and the work still to do, show that it will be some time before this magnificent station will be ready for business.

Heavy Freight Traffic on Pennsylvania Main Line.

A recent issue of the *Pittsburg Post* says:

"During the month of March 3,649 trains passed over the middle division of the Pennsylvania Railroad main line. Allowing forty cars as the average train, we have a grand total of 145,960 cars moved over the road in one month. The average length of a standard car these days is about 34 feet, including the couplings, and estimating on this basis we find that 758 miles of cars and engines passed over the road in the time stated. Each car would contain at least 25 tons, so that we can easily perceive that over 35,480,000 tons of freight passed over the division in the time mentioned above.

"This is a prodigious freight movement, and it shows the wonderful resources of the Pennsylvania Railroad and the immensity of its business. It takes a passenger train thirty hours to run from New York to St. Louis, a distance of about 1,063 miles, and if all the freight cars mentioned above were to move past Pittsburg in a continuous train at the rate of twenty-five miles an hour, it would take thirty hours for the train to pass without making a single stop.

"If an attempt is made to imagine a train rushing by at the rate of thirty miles an hour, and yet requiring thirty hours to pass a given point, some idea of the wonderful business handled by the Pennsylvania Railroad may be obtained.

"The great bulk of this freight business passes through this city, coming in from the Panhandle and the Ft. Wayne, which are the great feeders of the Pennsylvania Railroad, and it is said that Pittsburg and the Pittsburg district furnish 25 per cent. of the total freight traffic moved over the main line of the Pennsylvania Railroad."

Bangor & Portland Locomotive.

The Cooke Locomotive and Machine Company have recently turned out the ten-wheeler shown, for the Bangor & Portland Railroad. While there is nothing remarkable about this engine, it is thoroughly modern—a heavy engine for that road—indicating that they are alive to the advantage of heavy motive power.

The leading details are as follows:

Total weight in working order—110,000 pounds.

Total weight on drivers—84,000 pounds.

Total weight on truck—26,000 pounds.

Loaded weight of tender—78,000 pounds.

Total wheel base of engine—21 feet 11 inches.

Driving wheel base—11 feet 6 inches.

Cylinder—19 inches diameter by 26 inches stroke.

Driving wheels—Six, 54 inches diameter.

Engine truck wheels—Four, 26 inches diameter.

Driving axle journal—8 x 8⅞ inches long.

Engine truck axle journal—5 x 9¾ inches long.

Boiler, type—Crown bar, extended wagon top.

Boiler, working pressure—180 pounds.

Boiler, diameter first course—60⅛ inches.

Boiler, firebox—42 x 108 inches.

Boiler tubes, number—252.

Boiler tubes, diameter and length—2 inches by 12 feet 2¾ inches.

Boiler, thickness of shell—9-16 and ⅝.

Boiler, heating surface tubes—1,604 square feet.

Boiler, heating surface firebox—143 square feet.

Boiler, heating surface, total—1,747 square feet.

Grate surface—31½ square feet.

Style of grate—Hard coal, combined water tube and pull bar.

Slide valve—Richardson balanced.

Slide valve travel—5¾ inches.

Steam ports—1⅝ x 18 inches.

Exhaust ports—3 x 18 inches.

Lap—No inside lap; 13-16 outside.

Center of boiler from rail—7 feet 8¼ inches.

Top of stack from rail—14 feet 3 inches.

Tank, water capacity—3,700 gallons.

Tank, coal capacity—6½ tons.

LATEST COOKE TEN-WHEELER.

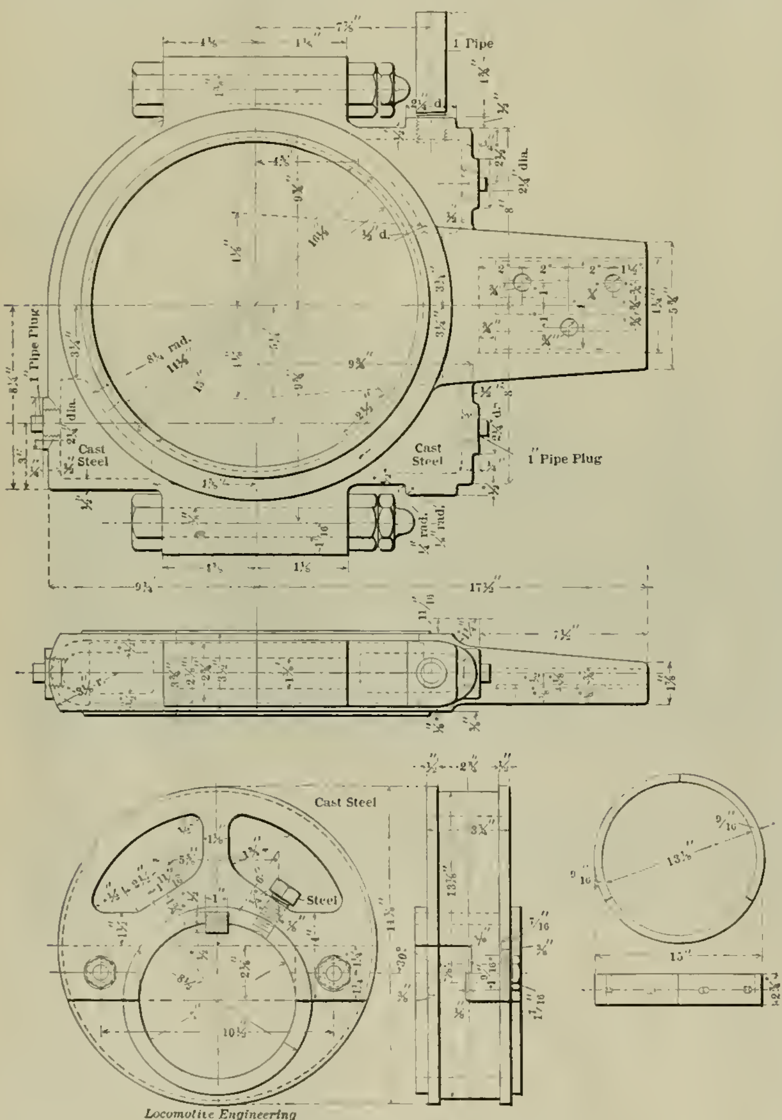
In describing the Baltimore & Ohio old locomotives last month, we said that the photographs from which the cuts were made were loaned by Mr. J. Snowden Bell, the well-known patent attorney, of Pittsburgh. This was a mistake, for we ought to have said original drawings instead of photographs. The drawings of the engines were made by Mr. Bell, who was then chief draftsman for the Baltimore & Ohio. The drawings are really fine works of art.

They have on the Pittsburg, Ft. Wayne & Chicago a favorite engine, which the trainmen have dubbed with the nickname "Billy McKinley." The reason they have applied this name to the engine is that she is always ready for business and never meets with failure. Through a blunder of someone in charge, she got off the track at the end of the switch lately, and another one, which has been dubbed "Mark Hanna," was ready to help her back on the track, but she backed right on without any assistance. The boys say that is a very good augury for the President of the United States.

Steel Eccentrics on the Erie.

The time-honored practice of making eccentrics and straps of cast iron has given way to cast steel on the Erie Railroad, and this is a fact worthy of note; but the design of the wearing surfaces in order to utilize the strength of that material and at the same time avoid its well-known propensity for cutting and seizure when two surfaces are in frictional contact, is what it is particularly desired to show in our illustration, from drawings kindly furnished by Superintendent of Motive Power Mitchell.

In section, the wearing parts of the eccentric and strap are exactly similar, both having a depressed surface at the center, with flanges at the sides; the strap being in this respect of practically the same shape as when made to fit a tongue on the eccentric. The object of this construction is to receive between the flanges a Magnus metal ring, 9-16 inch thick and 2¾ inches wide, which is sawed transversely into three equal parts. The ring is turned and bored to a free fit, and is therefore loose when between the eccentric and strap. There are three ½-inch oil holes in each section of the ring to insure good lubrication, and divide up the frictional resistance over the inner and outer surface, thus giving four bearing parts to take the wear instead of two as by the cast-iron method. We are aware that interposition of soft metal between these parts has long been the practice on foreign roads, and to some extent in this country. This design, however, whether new or old, seems, from the results obtained to be in many respects an improvement on existing eccentric practice.



STEEL ECCENTRICS ON THE ERIE.

"Fads and Fancies."—No. 5.

This month's chart shows a departure from the designs of the times (1863), and was built from designs of M. Petiet, then chief engineer of the Northern Railway of France, for use on his lines. The twelve wheels were 3 feet 6 inches in diameter, and they were grouped in sets of six.

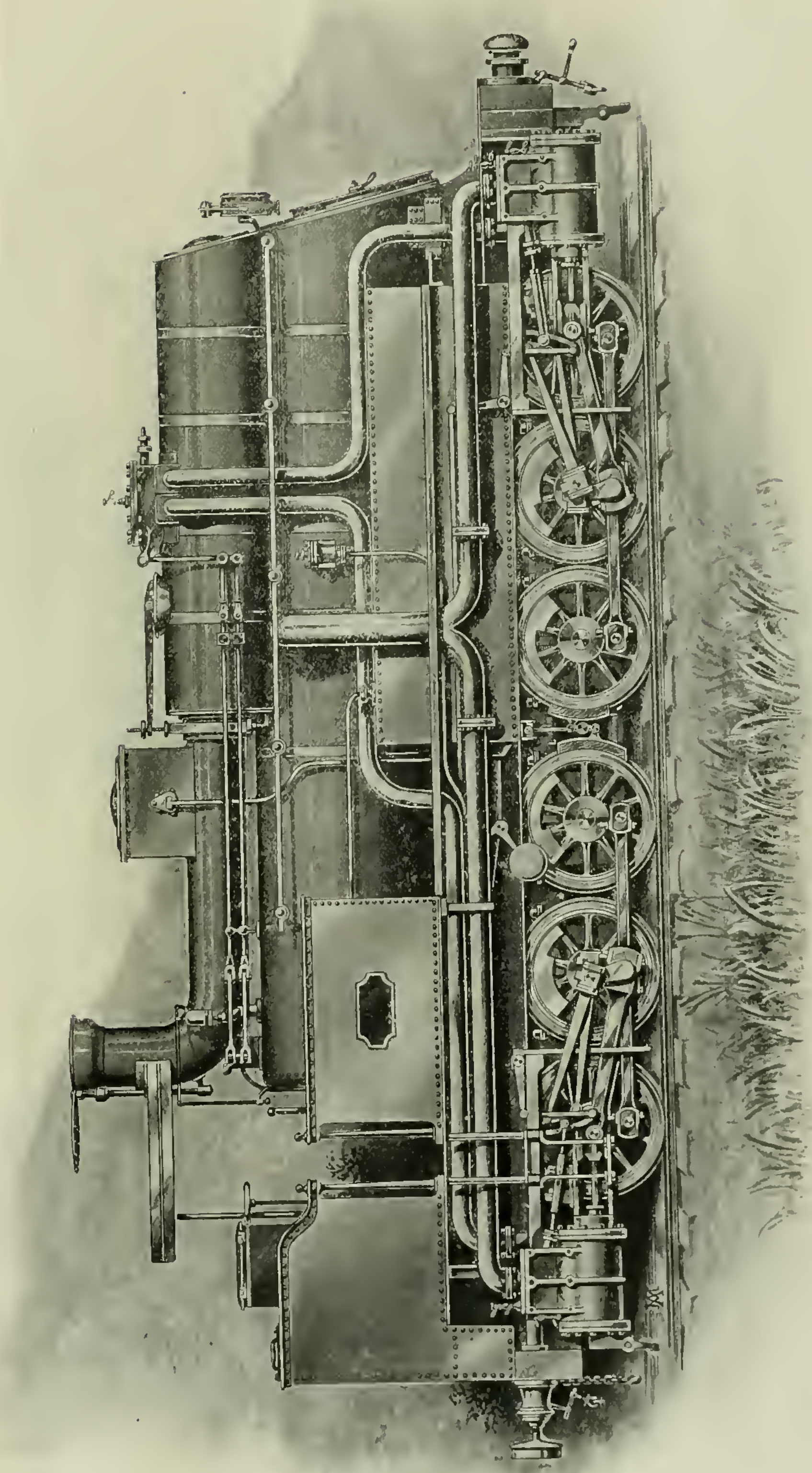
Each set was driven by a separate pair of cylinders, which were, approximately, 14 by 14 inches. There seems to be a condenser arrangement on the boiler, and it looks as though the smokestack might have been used as a feed-water heater. The sand ought to have kept dry in such a sandbox. It is not just clear what the object was in bringing the stack back so near the engineer, unless to keep his head warm or to heat his coffee can.

As will be seen, the steam and exhaust pipes form quite a network outside the boiler, and apparently lose much heat by radiation. The engine weighed about 59 tons.

Shop Radiators.

A good many fads have had the benefit of trial in steam heating of shops, giving scope to schemes in location of heaters that made the men who had to put up with them hot enough—in a figurative sense—as the overhead system is guaranteed to do; but to warm up a chilled anatomy in the shop, an ordinary simple radiator with plenty of heating surface, located near the work, is the most efficient for the purpose. Many of these, and good ones, too, are home made. The New York Central car shops at Buffalo have heaters of their own devising, that are made of cast-iron pipe of about 8 inches diameter, in the shape of two U-sections bolted together by means of flanges at the center. This radiator, sitting on the floor on short flanged bases, is about 5 feet long and 3 feet 6 inches high. A drain cock at the bottom and steam pipe connection at the top is all there is to this simple and liberal heating apparatus, of which there are two to the width of the shop and located between tracks the whole length. The men keep warm, and can work with comfort, without an ever-present desire to make a periodical sneak for the purpose of thawing out hands and feet. A mistake is made when a shop is not kept warm enough for men to work with comfort; a mistake from two standpoints—humane first, and financial next.

There seems to be an epidemic of rotary-engine fever sweeping over the country, judging from the number of patents on these delusive "steam chewers" which have been granted. If the germs of this disease are being imported from abroad, a high tariff is in order; there are enough freaks of the kind here already.



FADS AND FANCIES IN LOCOMOTIVE BUILDING—No. 5.

ANOTHER FRENCH ENGINE—PETIET'S—1863.

How to Lay Out a Locomotive Boiler—Method of Laying Out the Side Sheets.

BY HENRY J. RAPS.

Fig. 1 represents the end elevation of the inner and outer side sheets. The drawing should be made full size. It may be laid out on the back head-plate. The location of the staybolts should be marked off on the line which represents the outer sheet and lines be drawn normal with the contour of outer sheet to bisect the lines representing the inner side sheet.

Fig. 2 represents a section of the left side of fire-box and shows a part of back and flue sheets.

Fig. 3 represents a section of the left outer side sheet; also a section of the back head and throat sheet.

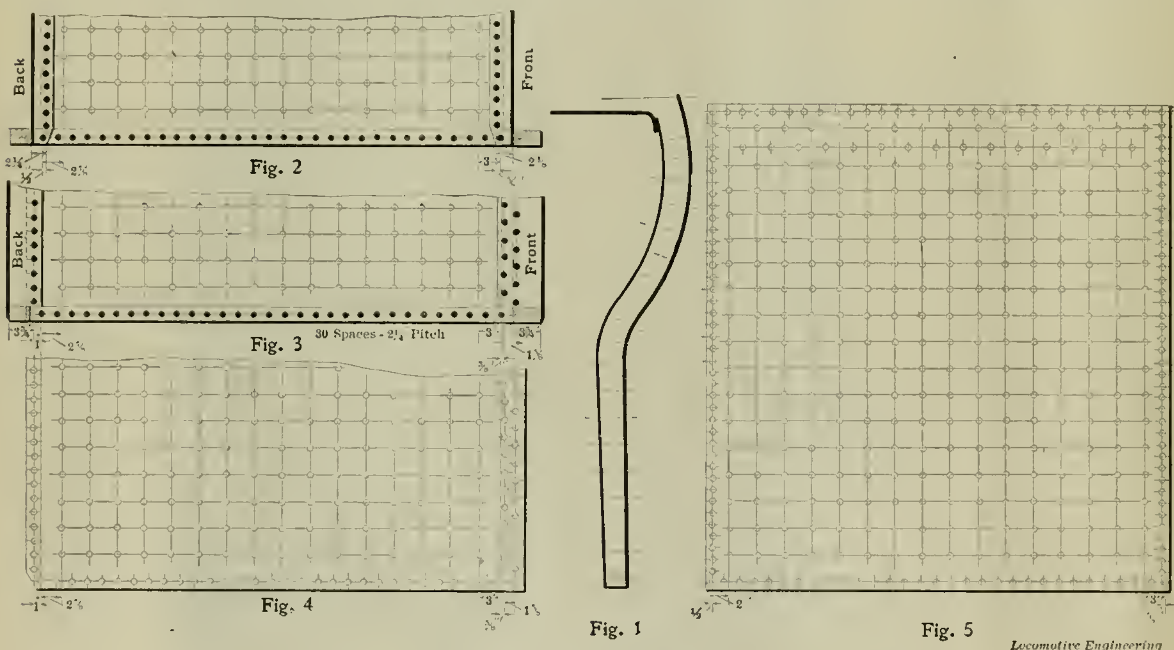
The location of seams and bolts in relation to the end rivet holes in ring are noted by figures and need no further explanation.

In laying out the holes in side flanges of end sheets for fire-box and end seams of side sheets, it is best to make two templates the thickness of side sheets; one template to be bent the shape of end sheets, the other left straight to lay out side sheet.

If there are but one or two boxes to lay out, a flexible strip of wood the same thickness as side sheets will answer the purpose.

To lay out the horizontal rows of staybolts, a piece of hoop-iron may be used and placed upon the inner line of Fig. 1. As this line represents the side sheet and shows its full thickness, it is necessary to place the hoop-iron along the center of the line. The location of bolts are marked upon it and transferred to side sheets, as shown in Fig. 5.

Fig. 4 is a section of the outer side sheet. It may be laid out in the same manner as Fig. 5.



HOW TO LAY OUT SIDE SHEETS.

In laying out any piece of work, we must have one or more definite points to start from. In this case we will take the end rivet holes in mud ring as these points.

Notice the lines drawn through Fig. 3 from the end rivet holes in ring and bisecting the end rivet holes in ring of Fig. 2. These two figures clearly illustrate the location of the seams and staybolts, and their distance from the end rivet holes. As shown, the seam in back end of box is one-half inch from end rivet hole in ring. As this hole is one and three-quarters inches from inside of ring, it follows that the holes in back sheet are two and one-quarter inches from outside of sheet. The first vertical row of staybolts in back end of fire-box side sheet is located two and seven-eighths inches from end rivet hole in ring, as shown; the first vertical row in front end three inches.

Anti-Friction Alloys.

A word as to the "anti-frictional" properties of babbitt: Rubbing surfaces, such as journals, guides, etc., do not come into contact at all. The oil keeps them apart—it would be a bad job for them if it didn't. This being so, it seems as if it wouldn't make such a very great difference what the metals were. It's when the parts run dry, or get hot and want to seize, that the virtue of white metal asserts itself, and keeps things going for a time. In the first place, the metal has a greater heat-conductivity, and so, for a given friction, induces a lesser heat, and therefore less expansion, in the bearing. Secondly, when the metal runs, it acts as a lubricant and prevents seizure for a while; for, evidently, the "brass" can't seize the pin so long as a layer of this fluid metal is interposed. When this is all thrown out (and the oil hole stopped up), the trouble begins.. An engineer's nose is usually his sentinel in such cases, but often the first intimation comes from the white metal, which, by giving timely warning, enables him to "avert the catastrophe," as newspapers would phrase it. When the "threepenny bits" begin to fly, the runner knows it is time to think about giving up his train. It's no use trifling with a hot main pin, especially if the engine is inside-connected, as in Europe. In such a case the driver would have a hole knocked through his boiler or his firebox front before he knew where he was. When the end of the rod goes through the firebox it generally makes things lively for those on the foot-plate.

So much for the safety gained by the use of babbitt, and, in fact, all bearing alloys.

One of the pleasing signs of returning prosperity is shown at the Baldwin Locomotive Works, in Philadelphia, where they are now employing 5,200 men, more than at any time in their history. The drafting room also has an enlarged force, there being ninety-four draftsmen at work. One of the best features is that most of the orders are for domestic railroads and not for export.

Wabash Ten-Wheeler.

This engine has been recently turned out by the Pittsburg Locomotive Works for the Wabash Railroad, from designs furnished by Mr. J. B. Barnes, superintendent of motive power and machinery. The leading dimensions and data follow:

Total weight of engine in working order—137,000 pounds.

Total weight of engine on drivers—108,000 pounds.

Driving wheel base of engine—14 feet.

Total wheel base of engine—24 feet 5¾ inches.

Hight from rail to top of stack—14 feet 7 inches.

Cylinders, diameter and stroke—19 x 26 inches.

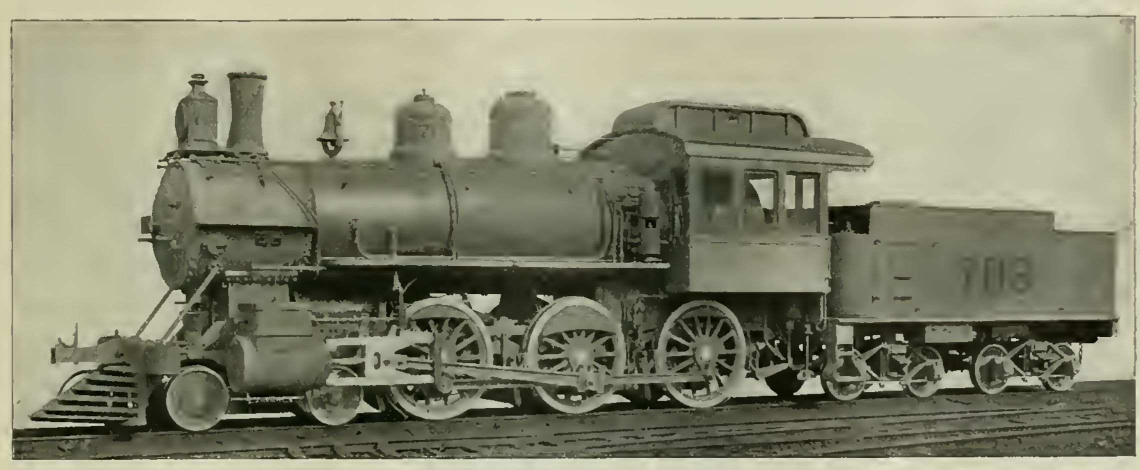
Type of brakes—Westinghouse American.

Water capacity—4,500 gallons.

Fuel capacity—10 tons.

Weight of tender with fuel and water—90,000 pounds.

There are several details which differ from the usual practice, among them being the coupler on pilot, the square number plate on the smoke-arch door and the straight handle beneath it. The cab is dropped lower than the running board. The stack is "narrow waisted," the idea being to obtain the best results from the draft on the fire. The strap on back end of guides and the rocker-arm connection with valve rod are also out of the ordinary.



PITTSBURGH TEN-WHEELER FOR THE WABASH.

Slide valves—Richardson balance.

Piston rods—Steel, 3½ inches diameter.

Diameter of boiler at smallest ring—62¼ inches.

Diameter of boiler at back head—73¼ inches.

Crown-sheet supported by radial stays—1 inch diameter.

Staybolts—1 inch diameter, spaced 4 inches from center to center.

Number of tubes—300.

Length of tubes over tube sheet—14 feet 3 inches.

Length of firebox, inside—101½ inches.

Width of firebox, inside—42¼ inches.

Working pressure—200 pounds.

Grate surface—29.92 square feet.

Heating surface in tubes—2,223.27 square feet.

Heating surface in firebox—186.16 square feet.

Total heating surface—2,409.43 square feet.

Diameter of driving wheels outside of tires—63 inches.

Diameter and length of journals—8 x 10 inches.

Diameter of truck wheels—30 inches.

Diameter and length of journals—5 x 9 inches.

Where Railroad Fares Are High.

A gentleman who has spent some time at Panama has recently written:

"I took a ride with the superintendent over the Panama railroad yesterday. This road is one of the best paying pieces of property in the world. It has made big fortunes for its owners in the past, and to-day its receipts are far in excess of its expenditures. What do you think of paying $200 to ride from New York to Boston, or $450 for a first-class railroad ticket from New York to Chicago, $1,000 to go from the Atlantic to Salt Lake City, or $1,500 to be carried over the iron tracks across the continent to San Francisco? Such a rate would be about 50 cents per mile, and this is just what the Panama Railroad Company received for every passenger it carried for more than thirty years of its existence. The length of the road is forty-seven miles, and the fare up until 1889 was $25 in gold. All through passengers on the New York steamers who have tickets for Panama are now charged $10 in gold for this railroad trip, and the local fare from Colon to Panama is $4 in gold, but the baggage rates at 3 cents a pound make this much higher, as only 15 pounds are allowed free."

A Slipping Cure.

We once in a while, in our travels, run across an over-cylindered old-timer that is not ripe for the scrap man, and yet is a stench in the nostrils of the party that is responsible for getting somewhere with her. These frolicky old birds need an automatic sanding device to hold them down to the rail, but sand is tough on tires. A heavy cast-iron deck has been found very effective in curbing the tendency of such engines to jump fences, and it is as cheap a method as any to overcome a bad design, or prolong the life of what is at best a failure.

There are other uses for the heavy deck besides the one of adhesion. It has been used to lift a portion of the weight off an engine truck and deposit it on the drivers. A case we can recall at this time is that of some moguls that were required for permanent yard service as switchers. These engines had their pony truck removed, which transferred the load that had been carried by the truck, back to the forward drivers. The excessive weight there quickly manifested itself in tire wear. It took over 12,000 pounds of cast-iron deck to counteract the overhang and reduce the load on the forward wheels to a safe figure, and is the greatest weight we ever heard of used in this connection.

The Bethlehem Iron Company, South Bethlehem, Pa., have been given the order for the shafts for the engines which the Metropolitan Traction Company of New York City will install in their new power-house. These shafts are 37 inches in diameter, 27 feet 4 inches long, with a 16-inch hole through them. They are made of fluid compressed open-hearth steel, annealed, and are hydraulically forged on a mandrel. The Bethlehem Iron Company is the only forge in this country equipped for turning out work of this character and magnitude. The cranks will also be made by this company.

Practical Letters from Practical Men.

All letters in this Department must have name of author attached.

Selection of Books for Enginemen.

Editors:

With the great array of good books by good authors in the railroad field, it would seem that there could be no reason why the progressive fireman or engineer should not be entirely up to date, and thoroughly posted in both the practical and theoretical branches of his business. The very fact, however, of so many good books to select from, we believe, has a great influence with the average man towards retarding instead of assisting him in his education. I have been asked many times by bright, intelligent firemen: "What is the best book for us to get, to post ourselves up with?" On asking them what books or authors they were familiar with, some would say Sinclair's, some Grimshaw's, others Roper's, still others Forney's, until we would nearly become bewildered. Our answer would generally be that we had read many, studied a few, but that we were only familiar with two, Sinclair's and Roper's, and that the latter we consider best for stationary work; but for an educating, plain and comprehensive book on the locomotive, and a work that, when studied, would never be forgotten, we would recommend the former. Sinclair's book on "Engine Running and Management" is a book without frills, and can be understood by an ordinary mortal without the aid of a dictionary. It is possible that I am partial to the above work, as it was the book placed in my hands as a fireman by the best engineer I ever fired for, and I have fired for many good ones. What I know of caring for and running an engine and of valve motion I owe to good engineers, Sinclair's work and careful observation.

I do not advise, however, men studying the air-brake part of above mentioned book, although it is good; but there are specially prepared books on this subject (air) that will be found better for the average air-brake student.

It would seem that many books, called authorities, are written more with a view of showing forth the author's educational advantages and a lot of high-flown language, jaw-breaking words, etc., than with a view of assisting the average fireman or engineer to an intelligent comprehension of the locomotive. Not long since, I was shown a book on combustion, and while I plead guilty of having a fair education and of reading much on this same subject, I must also plead guilty to a dizzy sensation and a feeling that I must be either dreadfully ignorant, or the author of said book dreadfully smart "and fearfully and wonderfully made." At school I had studied a little Greek and Latin, but I could not remember of seeing any of said book's language there; so, after careful thought, I concluded it was a two-thousandth century edition of combustion printed in the King's English by a Liverpool Irishman. Since reading up "Gilderfluke's Engine and Coupler," I have had thoughts that perhaps above mentioned book was also a "josh."

To firemen all over the country I would say: If you want to be posted on your business and wish to be considered smooth engineers, only study books printed, or rather written, by men who "have been there," and who write practice and not theory alone. Only a man with a poor education or poor taste will attempt to use language that the lowliest cannot understand. The best teachers we have ever had used the simplest language, and while I am far from being brilliant or wise, I am learning that a good deal of practice, with careful thought attached and with the experience of bright, practical men connected by reading sensible books, will give better results than a good deal of theory where practice is a secondary consideration, and where the student's guide-book necessitates the use of a dictionary every minute.

Two Engineers on the Delaware, Lackawanna & Western who frequently take turns in running the same engine. One weighs 360 pounds and the other 130.

I do not wish to be understood as advising the non-use of a dictionary, as a student or reader should always have one at hand for reference. I merely intend offering sensible suggestions to those who are the future engineers and who wish to become intelligent, useful men. Read plain books, and do not try to learn everything in one day, one year or fifteen years. We will never "know it all" in this life.

Do you know that the average scoop of coal weighs 13 pounds, and that if only one scoop is saved in each mile, that in your 100 miles you have saved 1,300 pounds of coal, and that, at $5 per ton, you have saved your wages for this mileage, and this is a very small saving? Many a poor fireman who is spading coal in the rear end of an engine, whose eagle eye is a "long stroker," could save even this amount of coal if he was taught how. But "Daddy Pound 'Em Hard" never fired any to speak of, and is fearful of going down in the "kitchen," as he might fall off; so the only assistance our poor stoker gets is what the traveling engineer tells him on his monthly tour, and as said traveling engineer is so busy watching "Daddy Hit 'Em Hard's" links to see if they are dragging on the ties, the poor devil wastes enough coal before he "catches on" to fill an elevator, to say nothing of what "Daddy" makes him waste. His only salvation is a sensible, comprehensive book. You can bet old "Daddy" never read Sinclair's "Locomotive Engine Running and Management."

L. D. SHAFFNER.

Missoula, Mont.

Electric Light from Car Axle.

Editors:

I notice in your April number that the Boston & Albany people are experimenting with a system of car lighting from electric power generated from car axle.

For your information I would bring to your notice the fact that the Atchison, Topeka & Santa Fé Railroad has had in service for the past five months over fifty coaches equipped with the system furnished by this company.

These cars comprise those in every kind of service, and are rendering excellent satisfaction, giving a brilliant light, thoroughly under control, and passengers can read easily in every part of the car.

The dynamo is fastened to truck frame and run by a belt from a pulley fastened on axle. The current generated by the dynamo is run into one of two sets of storage batteries; the lights burning off of one set of batteries while the other set is being charged. At stated periods the battery switches are thrown over, allowing exhausted batteries to be charged and lights to burn from full battery.

All functions of the dynamo and batteries are handled automatically by a switch-board placed inside of car; the train crew merely turning on or off the lights or dimming them at their pleasure.

Each car is a unit; but in case of failure, two cars are easily connected, the lights in both cars burning from the car desired.

In case dynamo fails to work, there is always sufficient power in batteries to run the lights sixteen hours at full candlepower.

Some of these cars run on limited trains from Chicago to California, with no attention besides being oiled by car inspectors, and they are in postal-car service, with long service under light before starting on run. But instances of failure of light have been exceedingly rare; so that the distrust with which a railroad man is inclined to regard an electrical appliance has been overcome by the beauty of the light and ease of managing it.

T. S. REILLY,
Inspector's Office, National Electric Car Lighting Co.
Denver, Col.

Abuse of Engine Oil.

Editors:

Enclosed I take pleasure in handing you a performance sent me of Engine 135, on the Houston & Texas Central Railway, which explains itself, and in the writer's opinion explodes the theory advanced in your comments on the writer's letter in your April issue respecting the limitation in the application of lubricating and cylinder oils for locomotive uses.

The performance statements of the Houston & Texas Central Railway show nine locomotives averaging upwards of 290 miles on the one pint of valve oil, and 65 miles to the one pint of engine oil, and the general average of their upward of 100 locomotives in all classes of service is about 150 miles to the pint of valve and 45 miles to the pint of engine oil. The facing of valve seats and boring of cylinders is almost unknown on this road.

But there are still a few railroads and a few railway journals in this country advocating the application of both cylinder and lubricating oils by the "fire-engine process," and of course at a cost per mile run of upwards of double what it should cost.

The performance being made on the Houston & Texas Central Railway is now duplicated by at least 70 per cent. of the railways of this country. This great saving to railways has been brought about in the past ten years by railways adopting the method of lubricating their locomotives and cars upon the mileage plan.

In the writer's opinion, there is not to-day a locomotive engineer, nor those that run locomotives before the flood either with or without cylinder oil, that knows just how many miles or how far they can run a locomotive with one pint of oil, if the oil is of good quality and is made to do what it ought to do. The slushing of oil into a pair of cylinders that are mechanically out of shape, by engineers that carry more water in the smokestack than in the boiler, will not cure the defect, and is a dead loss to the railway permitting such extravagance.

There is no reason why every railway owning and running locomotives in this country should not make as good a showing as the performance on the Houston & Texas Central Railway, and with no risk of sending their locomotives into the shops "with cylinders looking like a bird's-eye view of the Rocky Mountains." The slushing of oils into cylinders or on machinery will not cure mechanical defects or protect heating.

Cincinnati, O. J. S. PATTERSON.

Office of Superintendent of M. P. & M.
Houston, Texas, April 5, 1898.

J. S. Patterson, Esq., Cincinnati, O.:

Dear Sir—Complying with my letter of even date, I give you below a statement of the performance of Houston & Texas

A PENNSYLVANIA GENERAL SUPERINTENDENT PULLING 'EM IN.

Central engine No. 135 from October, 1895, to February, 1898, inclusive:

Miles made since first placed in service—124,020.
Pints valve oil used—420.
Average miles per pint valve oil—295.28.
Average miles per ton of coal—50.9.
Coal used—Bituminous.
Average train—About six cars.
Grade—1.2 per cent.

This is a Schenectady engine, having 19 x 24-inch cylinders, 69-inch wheel, and weighs 118,000 pounds. We have eight other engines of the same type, and put into service at the same time, which are making a similar performance. This engine has never had her valve seats faced since she has been in the service, and the cylinder packing has not been renewed. The valve seats and cylinders are nice and smooth, consequently you can see the engine has cost nothing extra for repairs.

S. R. TUGGLE,
Supt. M. P. & M.

Breaking in Locomotives.

Editors:

In connection with your correspondence on engines, I submit what I trust will be of value to a number of your readers, particularly engineers, on the proper method of breaking in or starting new and overhauled engines. If properly started, many a man will be saved trouble, and companies saved unnecessary expense, besides reducing possibilities of serious delays.

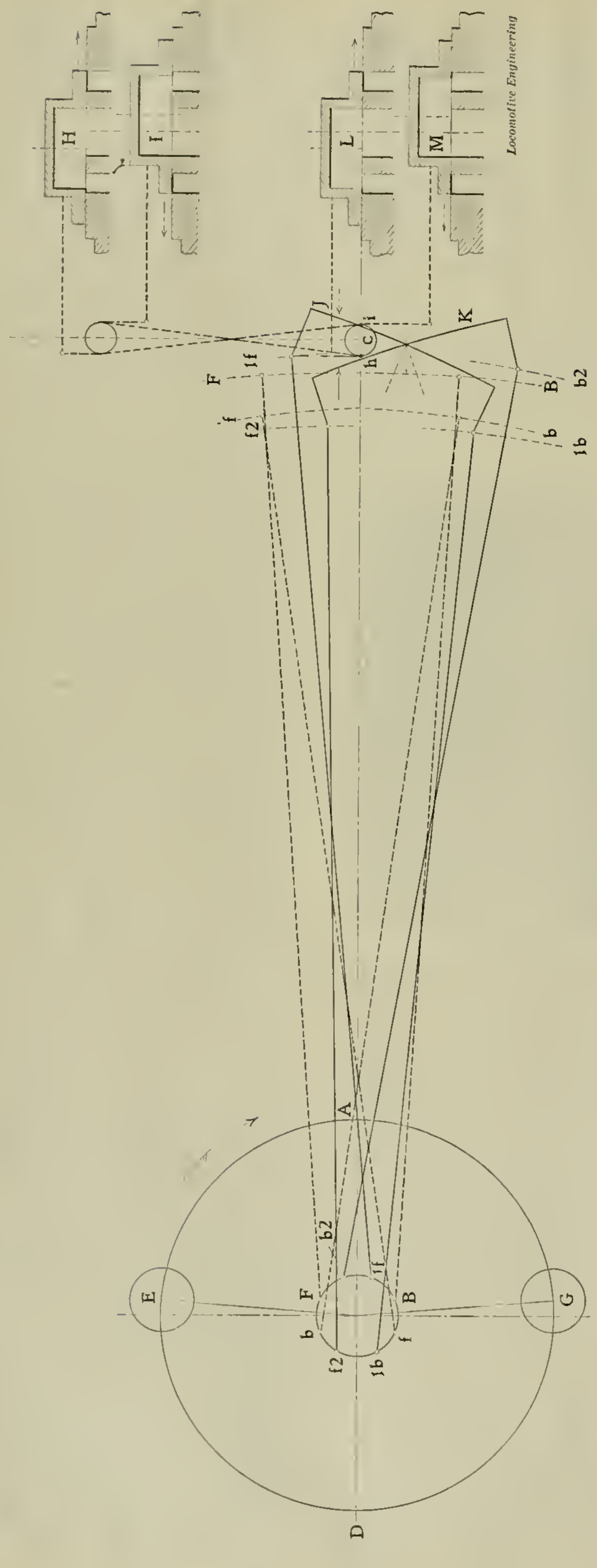
After a careful examination and oiling of all parts requiring it, the engine should be run very slowly for the first ten miles, with frequent stopping to see if anything shows a tendency to heat. Never let a journal get hot, for here are some of the sure results from heat: A cast-iron box with a brass bearing is a very deceptive thing. The brass is very liable to get warped or twisted and change the original bearing, and is pretty sure to lose its tight fit in box. The box itself will be found to have sprung from heating, and though you may cool it down and get it to run cool for a while, it is very liable, after getting a little side play, to get hot without any apparent reason. This has been caused from first heating. Never take for granted that the engine will stand fast running; but take it slow, and give everything a chance to come down to a bearing without getting hot.

The wedges should be pulled down and kept perfectly free until you are satisfied the boxes are in shape to set them up, and then they should be properly adjusted. Rod brasses also come in for the same care, for if allowed to heat, they change their bearing; but, unlike boxes, rods can be taken down and brass refitted very easily. With solid rods the bushings are invariably loose after heating, and have to be shimmed or renewed. This may not be noticed on trial trip, and after engine goes into regular service will cause serious trouble to men and train service.

Valves, valve seats, cylinder walls and packing, having the pores of iron open after boring and facing, require careful attention, slow, easy running, and oil to get down to a glossy surface, before they can be depended on. Eccentrics and straps are the same. I don't know of any branch in railroading where the saying of "an ounce of prevention is worth a pound of cure," is more applicable than in starting an engine in service; for I believe the first twenty miles an engine makes, she is either made or spoiled.

To look at it mechanically, it is only a process of grinding of parts to their proper bearing, and if done slowly and carefully, it will repay ten-fold the attention and labor it costs.

With an engine started this way, the boxes will run five or six months before the packing need be disturbed, and where the binder or brace must be removed to take down cellar, the packing of a box is no small job, and will be found pretty expensive. Shoes and wedges come in for their share of attention, and many a disagreeable pound will be avoided if their faces are properly started for wear. A rough-worn wedge set up snug will cause



LAYING OUT A LINK MOTION.

a hot box about as quick as anything I know of; and if the box sticks (or as a great many say, "stuck wedge"), you have got a disagreeable job on your hands.

Guides and cross-heads should be watched carefully, for if they show a tendency to heat, they can often be saved by the adjustment of a liner in guides. Links and connections very seldom give trouble, but they should get the same treatment as the rest of the working parts. After getting bearings down, the valves should be tested for beating square, which can be done by applying brake and working a good throttle. You can then test them in each notch of quadrant, and by opening fire-door listen for leaks in steam pipes, or blows. This is the time to locate all defects and have them remedied, before placing engine in train service. With the present requirements from our improved large engines, where they are rated by tonnage, it is necessary for everything to be in the best possible condition; for transportation officers require a satisfactory explanation for every minute's delay, and you may be sure, if they can, they will put it all on "Cause of engine failing."

Another feature is having driving boxes well started. They will stand to have tires turned or changed, virtually giving nearly same results as two overhaulings.

J. J. Flynn.

Louisville, Ky.

Irregularities of Cut-off With and Without a Rocker.

Editors:

Please explain why an engine having an ordinary link valve motion cuts off as follows previous to equalizing the cut-off with the saddle pin: In a direct engine earlier on crank end, and in an indirect engine—that is, with a rocker interposed like most American engines, the cut-off occurs earlier on the front end. I cannot conceive, as motion of connecting rod remains unchanged, how interposing a rocker and consequent change of eccentric positions can change early cut-off to opposite end of cylinder.

Henry T. Brate.

Milwaukee, Wis.

[An answer to the above is contained in the accompanying drawing of a valve gear with the crank pins shown for the half-stroke position of the piston—the point usually selected to show inequalities of steam distribution to the best advantage. A rocker with arms of equal length and a center line of motion coincident with center of cylinder, is assumed.

The centers of eccentric are designated by characters corresponding to elements on which the link positions are drawn, as *F B* and *f b*, for the forward and backing eccentrics, and 1*f*, 1*b*, the same eccentric centers after advancing through the same angle traversed by the crank in passing from the forward center *A* to the half-stroke position *G*. *f2* and *b2* are location of eccentric centers when the crank has passed from the back center *D* to the upper half-stroke position *E*.

Arcs are drawn from these centers with a radius equal to the length of the eccentric rods, which is the radius of the link minus the distance from the link arc of the center of eccentric rod pins back of the arc. The arcs thus drawn determine the position of the link, as the rod pins are resident in them. The arcs *F B*, *f b* locate the true position of the rocker and link block for the neutral or central position *c* of the valve over the ports. From *c* as a center a circle is described with a radius equal to the lap of valve, and points *h i* on the circle represent the steam ports opening or closing— that is, the steam edges of valve and port are line and line.

After having drawn the link arcs *J K* by means of a cardboard template cut to the correct radius—in this case 60 inches—and which has the eccentric rod pins properly located, together with a center line between the pins, and perpendicular to line drawn through their centers, the position of the arcs *J K* explains at once the effect of suspending the link on the arc. Considering the motion with the rocker first, it is seen that for the half-stroke position *G* of the crank, the piston is in its rearward stroke and the valve *H* is cutting off at the front port. An examination of the drawing shows that when the crank has reached *G*, the forward motion eccentric has moved to 1*f* and the backing eccentric has reached 1*b*. The link arc *J* is seen to have a movement in the direction of the arrow, and has passed the cut-off point *i*, showing that cut-off ocurred before the crank reached *G* on its backward stroke from *A*.

Next taking the movement of the crank in its forward stroke from *D* to *E*, it is seen that the forward motion eccentric has moved from *f* to *f2*, and the backing eccentric from *b* to *b2*, which has moved the link arc *K* in the direction of the arrow, and shows that it has not arrived at the cut-off point *h*, as it should have done to cut off at half stroke, in which position valve *I* is shown cutting off at the rear port. Cut-off is thus seen to be too early in the forward port and too late in the rear one when the rocker is used.

Tracing the movement of the valve without a rocker, for the rearward half stroke of the piston, or from *A* to *G*, it is seen that the forward motion eccentric *f* with its new setting now goes ahead of the crank instead of following, as in the case of the rocker, and it has reached *f2*, while the backing eccentric *b* has gone to *b2*, moving the link arc *K* toward the cut-off point *h*, but falling short of it, thus failing to cut off at the front port, as it should do, as shown by valve *L*. On the forward or return half stroke of the crank from *D* to *E*, the center *F* passes through an arc 1*f*, and the center *B* through a like arc to 1*b*. The link *J* has passed the point of cut-off *i*, whereas it should have been at that point, as shown by the valve *M*, which is cutting off at the rear port. The cut-off is therefore too early in the rear or crank port, and too late in the forward port. This disparity will, however, be greater than shown, for the reason that the eccentric centers, while correct for the rocker demonstration, should be slightly changed for the direct motion; this was neglected in order to use one drawing for both motions.

The differences shown in cut-off for the two ends of the cylinder have been universally assigned, by authorities on valve motion, to the angularity of the main rod, which is not true for a link motion. The effect of this angularity is to cause the crank to fall short of its true position when the piston is at half stroke during its rearward movement, and to overrun its true position when the piston is at half stroke during its forward movement. It has remained for Mr. F. A. Halsey, associate editor of the *American Machinist*, to discover and demonstrate that of all the errors to be corrected in order to have an equal distribution of steam, this one of the main rod is of the least importance; as a matter of fact, he found that the offset of the saddle pin from the link arc became less as the main rod was shortened.

The principal causes of disturbance found in his investigations were the angular vibration of the eccentric rods as next in importance, and the offset of the eccentric rod pins back of the link arc as the greatest. The first two errors tended to reduce the last, and it then became necessary to offset the saddle pin to entirely overcome the knuckle-joint action of the eccentric rod pins. To those who believe that the saddle pin is offset as a corrective for the main rod error, it will be a surprise to learn that the adjustment of the saddle pin for this disturbance is outside and not inside of the link arc. The results of Mr. Halsey's investigations of link-motion errors referrred to here will be published in book form from this office, under the title of "The Locomotive Link Motion." The work is now on the press.—Ed.]

Baltimore and Ohio Old Locomotives.

Editors:

There are some errors of statement in your description of the old Baltimore & Ohio locomotives illustrated in your April issue, which I trust you will permit me to briefly correct.

In the first place, the engravings were made from the original drawings, and not from photographs, as stated in your description. These drawings were made by myself, at and shortly after the time that I was employed as draftsman at Mount Clare shops, Baltimore, where the engines were built. I am therefore able to guarantee the entire accuracy of the drawings, except in the particular that the pump was placed on the left side of Engine 32, instead of on the right, as shown, and there was an injector on the right side.

All the engines were designed by, and built under the superintendence of Thatcher Perkins, then master of machinery. Engine 117 was the first of the large class of ten-wheel passenger engines, and was built with 18-inch cylinders and 64½-inch drivers. These dimensions were afterwards changed, as stated in Mr. Cromwell's letter. The other engines of this class had 60-inch drivers, and did not have a combustion chamber in boiler.

Only two of the five engines of the 238 class had stationary links; the other three had shifting links, as shown.

Nearly all of the working drawings for the engines of the No. 32 class were made by me, and I am quite familiar with the construction now. The boilers were 48 inches diameter, cylinders 19½ x 22, and drivers 43 inches. Twenty of them were built by the Grant Locomotive Works in 1865, and cost $20,000 apiece. Two more were built by Reaney Son & Archbold, of Chester, Pa., and three or four at Mount Clare shops.

J. Snowden Bell.

Pittsburgh, Pa.

Grand Trunk Portable White-washing Plant.

Editors:

I am to-day sending you, under separate cover, photograph of our new Middle division white-washing equipment.

We have been working in this direction during the last four or five years, but this year we have embodied a number of improvements that were found necessary by past experience. A glance at the photograph will show you the general construction of the arrangement.

We have utilized one of the small locomotive boilers, and have two 8-inch Westinghouse pumps situated on the side of the firebox. Steam is taken from the dome, down along the top of the boiler, to feed both pumps. The pumps can be worked separately or together, as is desired, but the general practice is to work both together.

The air is discharged into the large reservoir, seen immediately under the barrel of the boiler, and from there it is conveyed through a connection under the car (not shown in the photograph), then goes up through a pipe, alongside of the machine, entering at the top, and the pipe extends down through to the bottom of the machine. This keeps the liquid in constant agitation when the apparatus is in operation.

The liquid is drawn out of the bottom of the machine through a 1-inch pipe. There is also a ½-inch pipe tapped into the top of the machine, which comes down and joins into the 1-inch pipe. To this connection the hose is attached and passes to any required distance, through one line of hose, the air and the white-wash being formed into a spray right at the machine.

We have two machines, both being operated in the same way. The white-wash is mixed up in barrels, and strained through into the barrel you see standing alongside of the car, and from there it is pumped by the little steam pump situated alongside of the large reservoir. The discharge pipe passes underneath the car and rises between the two machines, and is delivered into either one or both at the same time, as is desired. You will notice the two pipes leading to the machine from the three-way cock in the center.

On the down steam pipe from the dome is attached a flexible hose on one side. This is for heating the water in which the white-wash is mixed. The branch going towards the front of the boiler leads to a little inspirator which supplies the boiler with water drawn from a tank, situated immediately under the smoke-box, containing 350 gallons of water. The steam pipe then continues down, to operate the little steam pump.

The air pump exhausts into the smoke-box, and the exhaust from the steam pump also joins into the exhaust from the air pump.

The hose-reel is situated in the front end of the car, as shown in the photograph, and on reel is kept 400 feet of ½-inch five-ply steam hose.

On the opposite side of the car, which cannot be seen in the photograph, is the painting machine, which contains 15 gallons of paint and is operated in a somewhat similar manner to the white-washing machine, excepting that two lines of hose are used from the machine to the nozzle—one conveying air, and the other paint—and is operated at the nozzle instead of at the machine, as is done with the white-wash.

Also, on that side of the car is arranged a pneumatic blower for cleaning out the tubes.

There is a connection made with the regular Westinghouse angle cock and coupling, on the opposite side of the car, to which a connection can be made with a locomotive, for pumping air, in the event of anything being wrong with the air pumps on the car, or where air plants are established.

An iron box is situated just at the back of the machine, which will hold one-half ton of coal for use on the car.

On either side of the coal box are situated two boxes for holding tools and other necessary small articles that accompany the car.

For the convenience of the men with the white-washing car, we have also a car fitted up with sleeping apartments and cooking arrangements and other necessary matter with a car of this kind.

The three men, as shown in the photo, go right over the different sections of the line and do all the white-washing.

The smokestack, as shown in the photo, is just half the length. It is made in this way for in-door work, so that the smoke-jack in the shops can slide down on top. When working outside, we put on the other section, which is easily handled.

By this arrangement we are enabled to get over a tremendous lot of surface and keep the shops toned up, at a comparatively small expense.

I would like to hear what some of the other railroads are doing in this direction, through the columns of your valuable journal; possibly we may get some pointers, tending to improve our equipment.

In fitting up the car this season, we have endeavored to make the matter as

GRAND TRUNK PORTABLE WHITE-WASHING PLANT.

complete as possible, knowing just about what was required by past experience.

Yours truly,

F. McHattie,

Loco. Foreman, Grand Trunk Ry.

London, Ont.

Japanese Engineers.

We were recently talking with a locomotive builder who has just been sending a lot of engines to Japan, and he spoke of the mechanical engineers of the Japanese roads as being among the finest he had ever seen or dealt with.

"We don't need to send men there to set up engines. The engineers know how to direct it as well as our men, for most of them are practical as well as theoretical. See this letter? Well, one of our engines broke a spring hanger—not such an uncommon occurrence either—and this is his letter about it. He figures out all the strains and stresses of the hangers, takes account of weights of all the parts, etc., and concludes, at the end of two pages, that the factor of safety is too low. He doesn't need any man to set up his engines, as I happen to know he is a graduate of the Massachusetts Institute of Technology and learned his trade in this country."

The letter was admirably written and showed a clear understanding of the case. As to the factor of safety, that is being looked into by the builder in question.

The air is again full of circulars of inquiry from the committees of both the Master Mechanics' and Master Car Builders' Associations, and one of the most recent ones from the latter—that on the care of journal boxes and best method of packing—has, in its title, as great possibilities to make a return of real value to the association for the time and attention given the subject, as any that has ever been investigated by its members. There are twelve questions in this circular, every one of which is of the most vital importance to the committee in framing a report, and every member should see to it that the committee has the benefit of his experience to aid them in their conclusions. Most especially is this true of those questions referring to dust guards and dust-proof journal box lids. Of these the dust guard needs perhaps the most attention, and if any member knows of a device that will prevent the entrance of dust to a journal box, he owes the information to the chairman of the committee, Mr. J. T. Chamberlain, M. C. B., Boston & Maine Railroad, Boston, Mass.

There are four great locomotive works in Glasgow and a large railroad shop where all kinds of new work and repairs are carried on, and the electric machinery in use in these shops for all purposes does not exceed 250 horse-power.

A Japanese Book on the Locomotive.

We hereby put before our readers the title page and portrait of the author of a book on the "Locomotive," written in Japanese, by M. Crizuka, locomotive superintendent of the Kobu Tetsudo

"My main aim, however, in writing you is to say that I am an author of a book on the 'Locomotive,' in Japanese. My work has been crowned with success, the present edition being in the fourth thousand. I will send you the book and

AUTHOR OF JAPANESE BOOK ON THE LOCOMOTIVE.

Kwaisha Railway, Tokyo, Japan. Some months ago the author wrote to our chief editor:

"Your book on 'Locomotive Engine Running and Management' was given to me by Mr. E. Longstreth, superintendent of the Baldwin Locomotive Works, when I was an apprentice there in 1887. I feel gratified at your vast efforts in working out the changes adapted to the locomotive of to-day.

you can judge the value of the work. I consider it great fame to be favored with any sort of a reply from you."

We cannot undertake to say much about the merits of the book, except to say that it is in two volumes, and one of them is profusely illustrated with first-class engravings, similar to those used in the later editions of Sinclair's "Locomotive Engine Running and Management." We incline to think that the book is unique in its kind, and that it is the first work on the locomotive brought out where the characters are read from right to left.

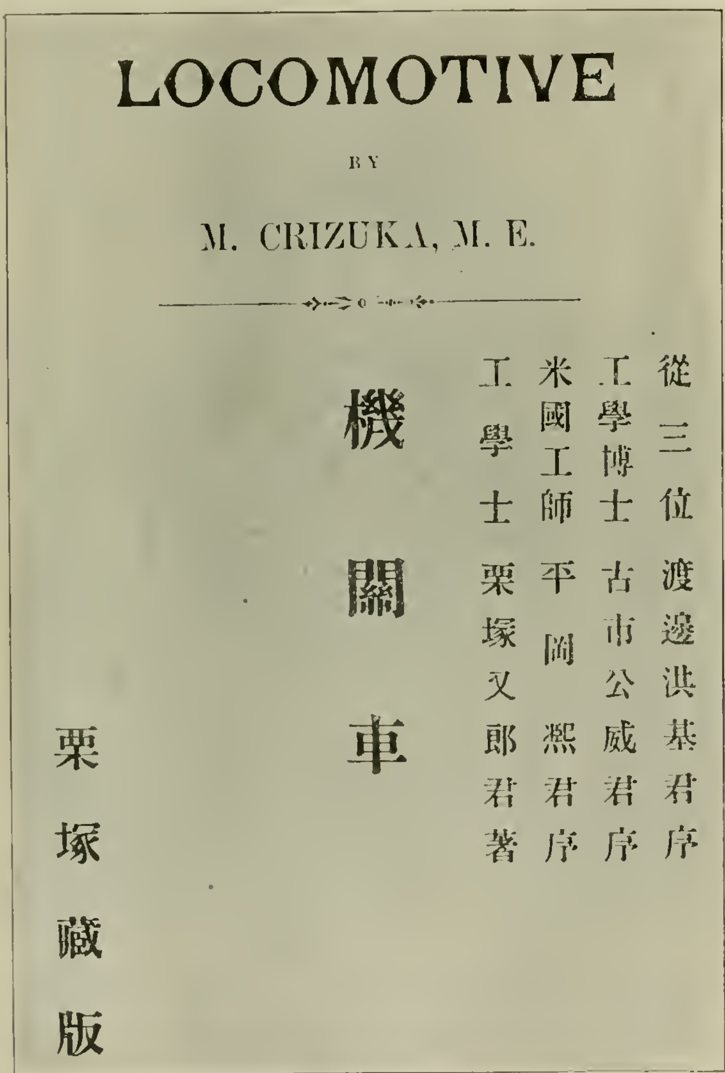
Mr. A. M. Waitt at Purdue.

Mr. Arthur M. Waitt, general master car builder of the Lake Shore & Michigan Southern Railway, delivered the eleventh lecture in the course of railway addresses before the engineering students at Purdue University on the 17th inst.

The course in which Mr. Waitt appeared was arranged with a view of presenting to the advanced students of Purdue the significance of the important problems making up the organization of a railway company. The general plan is to continue from year to year, the expectation being that departments having no representative in any given year will be given a place in the work of succeeding years. Mr. Waitt, representing the car department, called attention to the fact that more than a million cars enter into the equipment of American railways. He described the many different purposes which they are designed to serve, and called attention to the difficulties to be met in maintaining them in good order. The important problems to be met in car design were discussed in connection with a description of the construction of a typical box car. It is safe to say that the students to whom he spoke had never before imagined the variety and number of conditions to be considered in the construction of what to many may seem a rather simple structure.

The address was illustrated by means of colored charts, which served well to demonstrate the principal points developed.

The next and last lecture of the course will be given by Dr. Charles B. Dudley, of Altoona, who will represent the chemical department of railways.


LOCOMOTIVE

BY

M. CRIZUKA, M. E.

従三位渡邊洪基君序
工學博士古市公威君序
米國工師平岡凞君序
工學士栗塚又郎君著

機關車

栗塚藏版

TITLE PAGE OF JAPANESE BOOK ON THE LOCOMOTIVE.

New Power on the Long Island.

The Long Island Railroad is putting in commission some heavy eight-wheeled passenger engines designed by Superintendent of Motive Power Prince, and built at the Brooks Locomotive Works. These engines have 18 x 24 cylinders and 60-inch steel wheel centers, with 3½-inch Latrobe tires. The axles and crank pins are Coffin toughened steel; boiler pressure, 180 pounds; weight on drivers, 82,000 pounds, and on truck, 31,000 pounds; capacity of tank for water, 4,000 gallons; brake on all wheels, including engine truck.

These engines are equipped with the Sherburne track sander, which is operated by the sand lever or by air either from a cock, or from the engineer's valve, at will. Mr. Prince is now experimenting with this sander with the view of sanding the rails under the truck wheels as well as drivers. Little minor details that add comfort to the engine crew are quite noticeable in the cab arrangements, and help to make these engines what they look—modern in every particular, and a typical standard American machine.

Fast Time with Freight Trains.

Modern freight trains with air-brake equipment make fast time. An interesting example: Twenty years ago the average passenger train was run at the rate of about twenty-five miles an hour; freight trains at twelve miles an hour and even less; but during the past few years competition and mechanical improvements have been the cause of a marked change for the better.

To illustrate: A few days ago, on the Chicago, Burlington & Quincy Railroad, one of the most progressive and best-managed lines in the country, a train of stock left from Galesburg, Ill., for Chicago, a distance of 163 miles. The run was made in four hours and four minutes, including stops for coal and water. The actual running time was three hours and thirty-nine minutes, or an average of nearly forty-five miles an hour. The train consisted of nineteen double-deck sheep cars, seven cars of stock and a way car—twenty-seven all told. The engine was an ordinary low-pressure freight engine which had run 62,217 miles since it was last in the shops; 18,500 pounds of coal was burned during the run, an average of 5 pounds per car per mile.—*Pittsburg Post.*

An Old Engineer.

The portrait with this is that of Captain Jack Lawson, of Paducah, Ky., who is said to be oldest engineer alive to-day, and who claims to have run George Stephenson's first engine. As the first road to use Stephenson's engines was the Stockton & Darlington Railway, the Captain's history is a little twisted as to roads; but when a man gets to be ninety-four there's an excuse for not getting everything exactly straight, we probably won't either when we're ninety-four. We're sorry to learn Stephenson had a bad temper, but he probably had several things to vex him, even in those days before the spark-arrester man got after him. Here is what Captain Lawson has to say for himself:

"I was born on August 18, 1804, in Lancashire, England, and am now ninety-four years old," he said. "I was left an orphan when I was quite young, and had to hustle for myself. I did various odd jobs when I was a boy, and finally drifted into Liverpool, where I served my apprenticeship under Robert Stephenson, the inventor of the steam engine. Stephenson was a good fellow, but he was inclined to be cross, and many were the thrashings I received from him.

OLDEST (?) ENGINEER.

"But I stood the punishment, as it was a case of necessity, and finally Stephenson took a liking to me. When he first announced that he had invented a locomotive power that would supplant the old-fashioned stage coach and English hackney horses, he was ridiculed by nearly everyone. In fact, the name of Stephenson was used as a standing joke, but he was willing that incredulous people should have their fun at his expense.

"When he finally announced that he would run a trial trip from Liverpool to London, the people quit joking and became seriously interested. I well remember that trip. The engine was under the supervision of Mr. Stephenson, but I really had charge of it. The police had to clear the tracks for us to get out, so dense was the crowd. After we got out of Liverpool we expected to make headway, but it was nearly as bad all along the route. The people swarmed by thousands. Although the time we made was necessarily slow, still that trip demonstrated to science that Mr. Stephenson's invention was more than a mere dream.

"Six months later I came to America and brought the first steam engine across the ocean that was seen in this country. I took the engine to Baltimore, and the first trip was made on the Baltimore & Susquehanna to a medicinal spring twelve miles distant. The American people were not so incredulous as their English cousins, but they were more inquisitive, and a denser crowd turned out to see the trial trip than there was in England. I can remember every detail of the trip to this day.

"Two years later I went to Virginia and took charge of an engine on the Virginia & Roanoke Railroad. I remained there several years, and then came West.

"The engine that I brought over here only weighed 8 tons, and was practically a pigmy beside the 60-ton monsters of the present day. Now there is something in the history of this country that I want to disprove right here. It is the statement that the engines of those days could not make over twelve miles an hour. This is a mistake. The engine that was used for the trial trip in this country could make as fast time as those that are in use at the present time.

"I am proud of one thing in my life, and that is that I never had an accident while I was running an engine. I have made some noted runs, too."

Captain Lawson was until recently Collector of the Port of Paducah, having been appointed to that place under the Cleveland administration. President McKinley appointed his successor a short time ago. The captain is a fine specimen of physical manhood. He is 5 feet 10 inches in hight and weighs over 160 pounds. He says that he still feels active, and is good for many years yet.

Even allowing for the reporter's imagination and the captain's errors of history, he is quite a unique character at this time.

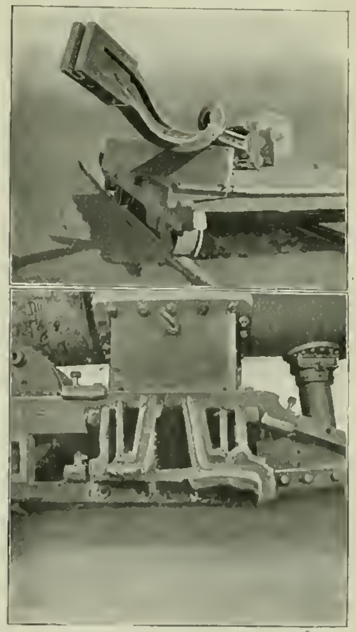
He Changed Cars.

Funny things happen on railroad trains as well as other places. Recently a traveler came over on Conductor Fineout's train from Ellsworth, Wis., who was ticketed to Stillwater. Just before reaching Stillwater Junction he was informed by Fineout that he must change cars in order to reach Stillwater. The conductor went on through the car and the aforesaid traveler very promptly reached for his luggage and deliberately walked from the rear car into the smoker and sat down with the air of a man who knew his business.

The train went on to St. Paul and so did the passenger who had "changed cars," but when he arrived near St. Paul he was the hottest thing that came down the pike from Ellsworth. He was finally quieted and checked back to Stillwater.

The balanced compound No. 1 owned by the Balanced Locomotive & Engineering Company, of New York, designed by George S. Strong, is now at work pulling heavy trains between Pittsburg and Gallitzin, on the Pennsylvania. The engine is said to be doing good work.

Malleable iron has made its appearance on the standard pilots of the Erie road, and they are greatly improved in looks and cost in consequence. The casting connecting the pilot to bumper takes the place of the old center slats, and also carries the Gould coupler, which is now applied to both ends of the engine, or rather on engine and tender. A very neat light spider casting of malleable iron is used to stiffen the three bottom members of the pilot, taking the place of the wooden fore-and-aft brace. A 3 x 4-inch angle iron with the wide flange above is used for a step on the bottom and makes the finish look like the present century.



THE MAIN ROD WAS TOUGH.

A new building is in course of erection to form an addition to the engineering laboratory of Purdue University. It is 50 x 100 feet, and will be known as the railway laboratory.

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Making and Keeping Boilers Safe.

As long as our monthly budget of news continues to record that certain disastrous boiler explosions have caused death and suffering, so long will we feel moved to discourse on the causes that lead to the supreme accident which can happen to a boiler. Considering the number in use, we do not think that locomotive boiler explosions are so common as explosions to other forms of boilers, but they are common enough to demand that every possible care should be observed to keep them in a safe condition.

It was not very long ago that disasters to boilers frequently resulted from the cheapest kind of inferior material being worked into boilers in the most reckless fashion that seemed to invite failure, but that is very rarely a source of weakness in locomotive practice now-a-days. The material from which boilers are made has undergone a highly elevating process in the last few years. It does not pay now to make worthless boiler steel, and so the material is of a fair average, a much higher average than formerly used. The parts where the greatest temptation prevails for making inferior material provide their own checks. Nobody will make very inferior firebox steel and expect to sell it repeatedly to any railroad company.

It may therefore be admitted that all locomotive builders leave the boilers in sufficiently good condition to stand for a few years the ordinary wear and tear of hard service. There may be leaky seams and other evidences of inferior workmanship; the staybolts and rivets may leak, giving testimony that contract work without thorough inspection may cause considerable annoyance to the purchaser; but there is no actual danger attending these defects. The boiler is not likely to blow up because a horizontal seam or a mud ring leaks, or because the staybolts and firebox rivets spray the fire with moisture. Although defects of that kind are annoying and are likely to put the builders of a locomotive into disrepute with the purchasers, and therefore do not pay, they do not jeopardize the safety of the boiler. With the average material and workmanship put on a boiler made to carry 200 pounds per square inch, it will do the work safely until deteriorating influences get in their work, and that generally extends over the first chapter of the history of a locomotive.

The peculiar form of a locomotive boiler and firebox has within it an element of weakness which tends to destruction if the weakening tendencies are not controlled. The flat surfaces inside the firebox have behind them a tremendous pressure of steam that tends to push them inward. This destructive force is resisted by staybolts that tie the outer and inside sheets together. These staybolts have a wonderfully important duty to perform, and too much care cannot be taken to provide staybolts capable of enduring successfully the conflicting strains they are subjected to.

When the total pressure of the steam at its highest tension tending to push the side sheets of a firebox inward to cause disaster is figured up, and the strength of the staybolts provided to resist the pushing-in action is also calculated, it seems, on a superficial examination, that the margin of strength is sufficiently great to make the staybolts last during the whole life of the boiler. But that is merely the superficial view, and further examination and consideration inform us that there are agencies at work which tend to destroy and shorten the reliability of the metal of the staybolts. The metal has not only to resist the pulls of varying tension due to the pressure of steam, but it is continually operated upon by a bending action due to the movement of the firebox. The forces of expansion and contraction due to the variations of temperature are so powerful that no binding of braces is sufficient to keep the firebox at rest. It is constantly lengthening and shortening. This puts the same kind of stress upon the staybolts that a wire receives when it is taken between the fingers and bent to and fro. When subjected continuously to this treatment the wire breaks in a few minutes, and the staybolt breaks in a few years. Some kinds of wire will break much more readily than others, and it is the same with staybolts.

Experience and various kinds of tests have given people reliable knowledge about the material best adapted for making staybolts. Considering the importance of preventing breakage of staybolts, it might be supposed that the greatest possible care is exercised in the selection of the material to be used, but we are sorry to confess that such is not the case. We have reliable information to the effect that the hard times which generated a passion for cheapness had a most depressing effect upon the demand for good staybolt iron. While talking on this subject quite recently with the mechanical head of one of the largest railroad systems in the country, a system noted for the rarity of boiler explosions, the man who had kept up this desirable record remarked: "Our good fortune has been due mostly to what in other lines of work would be called good business methods. The best staybolt iron is never too good for me. When anybody comes and tries to sell me cheap staybolt iron I intimate that he is trying to get my department into trouble."

That is a very sensible sentiment, and one worthy of universal acceptance. When good plates, good staybolts and good workmanship are invested in the construction of a locomotive boiler, it is sent forth upon its trying duties prepared to act satisfactorily. It can be depended upon to remain safe until the ordinary deterioration brings about the time for repairs. If those in charge of the boiler have attended to their business properly, they have taken care, by systematic inspection, to follow the condition of the boiler, although it has given no trouble. Good material well put together provides a first-class boiler. If cared for properly, a boiler of that kind will never be a source of danger.

Cylinder Proportions for High-Pressure Steam.

We once heard an eminent mechanical engineer remark: "I have seen working steam pressures advance from 20 pounds to 200 pounds to the square inch, and every step has resulted in the saving of heat." That was said by a keen observer who had built steam engines, had been in charge of steam plants, and had enjoyed extensive experience in conducting tests of steam engines and boilers. This varied experience certainly imparts to his views the weight of competent authority. We mention the subject now because we have several times lately heard railroad men express the belief that there is no economy in raising the pressure above 140 pounds per square inch, unless for compound engines. There is no question that the energy of high-pressure steam can be better utilized in compound than in simple engines, but increase of pressure produces steam saving in any kind of engine if it is used with proper intelligence.

Steam engineering is part of an exact science which has demonstrated a great many facts about steam which are as invariable as a geometrical problem or a rule of arithmetic. One of these is that, disregarding the condensation of steam as it enters the cylinder, the economy of the engine is shown by the proportion that the mean effective pressure bears to the terminal pressure in the cylinder. The mean effective pressure represents the amount of work done; the terminal pressure represents the volume of steam used.

We understand it is true that motive-power men have sometimes been unable to find any steam economy to result from raising the pressure, but there is good reason for believing that this was due to faulty cylinder proportions which prevented the high-pressure steam from being used to the best advantage. If the cylinder proportions are maintained the same for high-pressure steam as they were when the boiler tension was 40 per cent. less, then the engine is certain to profit less than it ought to by the higher pressure.

Certain designers have reasoned thus: We have a certain class of engine, say class "A," which gives entire satisfaction in service and is fairly light on fuel and repairs. But we might secure the saving that results from increase of boiler pressure, and to obtain that all we have to do is to make a stronger boiler. In ordering a new lot of engines that change is made. When the engines go into service they are found to be more powerful than those with lower pressure, but they use about the same amount of fuel to do the work. The old engines can do their work most of the time when cutting off at quarter stroke, and that is where the new engines are worked. As the latter have too much power to hold the train at the regulation speed, the steam is throttled to even it down to the capacity of the old engines.

Now suppose the cylinders are 20 x 24 inches, and, as has been mentioned, the greater part of the work is done at quarter stroke. When steam of 140 pounds gage pressure is employed, the cylinder pressure to the point of cut off will be, say, 110 pounds. This will give a mean average pressure throughout the stroke of about 58 pounds. The area of a 20-inch piston is 314.16 square inches. When that area is multiplied by 58, the mean effective pressure, it will show that the total pressure pushing the piston throughout the stroke has been about 18,221 pounds.

To make the engine with the high steam pressure of the same power as that just figured out, a smaller cylinder can be employed. The initial cylinder pressure in an engine carrying steam of 200 pounds gage pressure will be about 160 pounds to the square inch, using the same percentage as we did in the other case. This will produce an average cylinder pressure throughout the stroke of 88 pounds. It is then apparent that the required amount of tractive power can be secured from the higher pressure steam in a much smaller cylinder than that used with the steam of 140 pounds gage pressure. A piston 16¼ inches diameter has an area of 207.395 square inches. This multiplied by 88, the mean cylinder pressure, shows that a pressure of 18,250 pounds has pushed the piston throughout the stroke, almost the same power exerted through the 20-inch piston.

Now let us figure out the relative volumes of steam used in the large and the small cylinders to perform the same work. Disregarding the clearance space, the 20-inch cylinder requires 1,884.96 cubic inches, or 1.09 cubic feet, of steam to fill the cylinder for the quarter stroke; while the smaller cylinder space is filled with 1,244.37 cubic inches, or .72 of a cubic foot. The difference in the volume of steam supplied to the two sizes of cylinders does not represent the saving effected, because more heat has been put into the steam of higher pressure, the terminal pressure is higher, and the variations of cylinder temperature are much greater with the high-pressed steam. This latter causes increase of cylinder condensation which steals no small part of the heat energy; but it is safe to say that the net saving resulting from the use of the smaller cylinder is at least 20 per cent.

If the engine has sufficient weight on the drivers to give proper adhesion when using the larger cylinders, it will make a much more powerful engine than one with the smaller cylinders; but if the small cylinders are sufficient for the work to be done, there is no use in making them larger. Margin of power is a very good thing sometimes, but the most satisfactory results are obtained when the margin is in the boiler.

Good and Inferior Axles.

Once upon a time a Certain Railroad Company ordered 500 freight cars, and to carry them the powers that were ordered axles that had a bad reputation for quality. The official at the head of the car department was not the man who ordered the cheapest axles in the market. His part in the transaction was to stand the blame and abuse when the day of failures and wrecks due to the inferior axles came about. The cars were duly delivered, and were sent into the far ends of the railroad world with merchandise. About the time they began to make acquaintance with the different States of this continent, business languished so that the principal avocation of cars was standing in sidings with grass twining between the bars of their diamond trucks. The new cars with the shoddy axles had many opportunities for resting in sidings, and their different members withstood that kind of work without a break or murmur.

Years passed and a period came round when railroad companies found use for all their cars, and even were urged against their will to order new ones. At this time the Certain Railroad Company mentioned called for bids on 500 new cars, and as there had been no particular trouble experienced from the cheap axles of the previous lot, with one accord axles at about one cent a pound were ordered for the new cars. A feeling had touched the purchasers that cheap material gave just as good service as that which was called first class and was charged for accordingly. About this time the company needed new locomotives, and the superintendent of motive power ordered cheap axles for the tenders. He had opposed the cheap axles for the first lot of cars, but finding that they had given no trouble, he was now thoroughly converted to the cheap policy.

Business began to boom, and cars were scarce, so that those in use were kept humming. All the new locomotives entered at once upon double duty. Three weeks after the second of the new engines was received, a tender axle broke and a gulley at the foot of a grade held chaos in the shape of live stock changed, lumber and general merchandise that were loaded in fifteen cars at the front of the train. Loss to the company, $30,000. The following week word reached headquarters of wrecks caused on foreign roads by the failure of axles on two of the first lot of cars. The officers had not recovered from the shock of this bad news, when another of the tender axles broke with disastrous effects. Then the trouble became epidemic.

One of our scribes had occasion to condole with one of the leading objects of the annoyance from breaking axles shortly afterwards, and the recurring breakages were spoken of as mysteries that were outside ordinary comprehension. "You see," remarked the superintendent of motive power, "if it had not been proved by four years of service under cars, that the Bessemer axles were as good and as free from accident as any axles we had ever put under cars, we would have suspected the material, but we have had proof that the material is all right. I have been opposed to believing in mysterious breakages, but my faith in every failure being due to preventable causes has been undermined."

The question was then asked: "Are you sure that the first lot of axles gave entire satisfaction?"

"Certainly. They were in service four years before a single breakage happened."

"But what kind of service? Did they do work enough to be put to the test?"

That opened the way for a discussion in which the expression "fatigue of metal" was frequently mentioned. The scribe held that a poor axle, a weak truck or a bolster lacking the necessary strength, might run for years if the periods of rest were sufficiently prolonged. He argued that continuous hard service exerted an all-powerful influence upon the durability of any member of the rolling-stock family subject to hard work. The theory was advanced that had the first lot of cars been run as regularly as were the tenders where premature failures took place, the car axles would have promptly demonstrated the inferior quality of the material from which they were made. Thus it goes that the service of an axle is like that of the link of a chain, a spring, a truck or a side rod. It does its work for a time without sign of distress, and unexpectedly it fails without any apparent cause. The real cause is that it has outlived its period of durability. A first-class article has a longer life than an inferior one, but both will fail sooner if the service they are subjected to is exacting. Both resemble measures of water put into a tank to be used for a useful purpose. One may represent a million gallons to be run out at the rate of a gallon a minute; the volume of the other may be ten millions of gallons to be run out at the rate of ten gallons a minute. Both supplies will be exhausted about the same time. Looking at good and poor axles in the light of relative measures of water put in a position for doing useful work, the big reservoir costs relatively much less than the smaller one, and that is why the superior article is much the better bargain.

Instruction That Instructs.

The authorities of Clemson College, South Carolina, are preparing to open a Textile Training School, which will be conducted on a highly practical plan which is worthy of imitation by instructors in other lines of mechanical instruction. It will be similar in design to a small model cotton factory. It will be equipped with specimen machines for the work of the various departments of a mill in the manufacture of cotton. These machines will be set up and equipped to be operated. Besides lectures and the study of text-books on the manufacture of cotton, each student will be required to analyze the construction of each machine by taking it to pieces and putting it together again. This will be done under the direction of an instructor, who will explain the functions of the different parts of the machine. A careful explanation will also be made of the manner of adjusting the various machines for different work.

We would suggest that the colleges which are instructing students in locomotive engineering adopt a similar plan. They might strip the locomotive they have, and give the students practice in taking down the parts and putting them together again. This would give a much more lasting impression of the details of locomotive construction than merely studying the parts by means of drawings.

In various parts of the country there are schools of instruction formed by firemen for the purpose of studying railroad rolling stock matters. If these men would secure the loan of an old locomotive and practice taking down the motion and putting it together again, they would obtain information that would be highly useful to them in case of accident on the road. Nearly all railroad companies have locomotives waiting to be broken up which would readily be loaned for this purpose.

Fast Runs Too Numerous to Mention.

We wish to apologize to many friends and readers who send us for publication particulars of fast runs made on railroads. No month ever passes that we do not receive notices of this kind, and they have become so common that it is impossible for us to find room for them. Speeds of eighty and even ninety miles an hour are by no means uncommon, and those who write of an average speed of a mile a minute seldom fail to explain that the train was particularly heavy, or that other circumstances militated against high speed.

The capacity of our locomotives to make high train speed, and of our railroads to keep high speed safe, indicates great advances in the course of two decades. Quite a furore was caused in American railroad circles twenty-two years ago by a train on the Canada Southern running 111 miles in 109 minutes. *The Railway Age*, commenting on this run at the time, said: "It is said that one mile was made in 54 seconds, which would be a rate of seventy miles an hour—a speed that has been attained in England, though probably not for years. Sixty miles an hour is not an extraordinary pace on some English railways, but it is a terrific rate to keep up for 100 miles."

Unnecessary Delays.

One of the greatest questions regarding fast time on railroads seems to receive the least attention in many cases, although it has been mentioned several times in these columns; this is, the time lost at stations.

We recently saw one of the fastest trains in America—remarkably fast on account of the character of the country run through, with its grades and curves—after straining every effort to make time, wait eight minutes at a station for baggage to be loaded, orders, etc. No part of this could be attributed to the engine—that had been changed before and was ready for a 140-mile run. It was simply due to lack of proper management in handling the passengers and baggage at stations.

The minutes slip by very rapidly at stations and easily, too; much more so than they can be made up on a run of this character, and it is asking too much of the motive-power department to make up losses of time which can be readily avoided by a little care and systematic management.

It is not only trying to the engineer and fireman, for they have nerves as well as others, but it is expensive in dollars and cents, as it takes extra power to make up time, and extra power means more coal, more oil and greater wear and tear on the machinery. It is much cheaper—as well as being easier, if you go at it right—to save time at stations than on the road, and we believe this is well worth looking after.

Dawn of the New Car.

Improvement in freight-car design goes on apace, not alone in the direction of working up details of a lighter and stronger form, but in choosing and applying the best means of making a car larger, better for the service, and at a reduced cost per ton of capacity than has been done heretofore. The significance of this persistent striving after results in a new field, to the sacrifice of old methods and materials is apparent to all, except perhaps those that are not in full sympathy with the outlook. It means that cars are to be designed in the future by men versed in the mechanics of materials as well as in shop practice.

The effect of such a combination is even now to be seen in some few instances, and it will grow until a car will be a creation on rigid engineering lines. There are few who will dissent from such a prospect, for it has come to be a necessity that can only be met by the treatment predicted, and for this reason: The old, small equipment that owed its existence to an order of things now outgrown, requires so many more cars for a maximum loading of the present-day power, that owing to the great length of the train, the increased resistances reduce the paying load to a point far below that which could be hauled in fewer large cars.

The cost of maintenance of the greater number of units as compared with the smaller, is another factor in the problem that is of weighty import, since it has not been shown that the large car costs any more than that of lesser capacity, to keep it moving; and if the large cars are built of steel, as those of 40 and 50 tons capacity should be, then the necessity for comparison in this respect between the two types ceases at once. The engineering difficulties connected with a construction that shall satisfactorily meet all requirements are fairly well understood, so far as the metal car is concerned—the later examples give proof of this—and explains why the large car is now out of the experimental stage. It is here for a protracted stay. The next move should be in the direction of a standard for details of construction.

BOOK NOTICES.

"A Course in Mechanical Drawing." By John S. Reid, Instructor in Mechanical Drawing and Designing, Sibley College, Cornell University, Ithaca, N. Y. John Wiley & Sons, New York. Cloth, $2.

This work is the result of a need felt by the author for a text-book suitable for his own use as an instructor. It contains the usual matter found in books of the kind, with this difference—a careful avoidance of voluminous treatment of unnecessary details in cases where the subject matter can be improved thereby. The student is advised as to the purchase of instruments, and their uses are plainly indicated; after which is a series of studies in geometrical drawing. This is followed by conventional section lining, lettering and figuring, orthographic projections and development of surfaces from practical dimensioned drawings, of which the wagon-top and dome sheets of a locomotive boiler are good examples; line shading and isometrical drawing are also included in the work. The book is 6 x 9 inches, and contains 128 pages and 168 engravings.

"Machinists and Engineers' Pocket Manual." Edited by D. B. Dixon. Published by Laird & Lee, Chicago, Ill. $1.

This is a very handy little pocket-book for the engineer or machinist, giving a number of useful tables and information on gearing, refrigeration, etc., etc. There are a lot of promiscuous examples to which special attention is called by the publishers, but which do not explain the "why" of the operations, or even give the formulas used, although the examples are worked out very briefly. One of them on screw cutting contains a typographical error which might readily puzzle a student, but which will probably be corrected later. This criticism does not condemn the book, but only points out a way to improve it. It will be found useful in many cases.

There has been a little unavoidable delay in getting Mr. Halsey's book on "Locomotive Link Motion" into shape, but it will be ready by the time this issue reaches its readers. This is without doubt the best book on link motion that has ever been issued, and is sure to become very popular. It is thoroughly illustrated, so as to make clear all the points which might otherwise puzzle a man, and is written more plainly than any other book on this subject—most of them are so dry they make a man thirsty. This has been such an expensive work that we are compelled to make the price $1 instead of 50 cents, as at first intended.

PERSONAL.

Mr. S. M. Roberts has been appointed general foreman of the Plant System at Waycross, Ga.

Mr. B. R. Brandow has been appointed master mechanic of the Leavenworth, Kansas & Western, with office at Leavenworth, Kan.

Mr. W. C. Halfman has been appointed master mechanic of the Chicago & Southeastern at Lebanon, Ind., succeeding Mr. J. W. Roberts.

Mr. J. J. Thomas has been appointed master mechanic of the Montgomery division of the Mobile & Ohio Railroad, with office at Tuscaloosa, Ala.

Mr. W. F. Beardsley, master mechanic of the Pennsylvania shops at Allegheny, Pa., has had his jurisdiction extended over the Erie & Ashtabula division.

Mr. Percy Webb has been appointed master mechanic of the Panama Railway, vice Mr. D. G. Mott, deceased; headquarters at Colon, Colombia.

Mr. D. Willard, assistant superintendent, has been appointed superintendent of the Wisconsin division of the Minneapolis, St. Paul & Sault Ste. Marie.

Mr. F. C. Bachelder has been appointed superintendent of the Minnesota division of the Minneapolis, St. Paul & Sault Ste. Marie; headquarters at Minneapolis, Minn.

Mr. Thos. W. Demorest has been appointed general foreman of the Terre Haute & Indianapolis shops at Terre Haute, Ind., vice Mr. W. R. McKeen, Jr., resigned.

Mr. R. W. Bryan has been appointed superintendent of the Fergus Falls division of the Great Northern, vice Mr. F. H. Britton, promoted; headquarters at St. Cloud, Minn.

Mr. E. Pennington, superintendent of the Minneapolis, St. Paul & Sault Ste. Marie, has been appointed general superintendent of that road; headquarters at Minneapolis, Minn.

Mr. J. G. Justice, general foreman of the Plant System at Waycross, Ga., has been promoted to the position of master mechanic at Savannah, Ga., vice Mr. D. B. Overton, resigned.

Mr. J. B. Kemp, superintendent of the Memphis division of the Illinois Central at Memphis, Tenn., has been transferred to the Aberdeen division, with headquarters at Aberdeen, Miss.

Mr. George W. Prescott has been appointed foreman of the Terre Haute & Indianapolis shops at Logansport, Ind. He was formerly superintendent of motive power of that road.

Mr. Cornelius Shields has tendered his resignation as general superintendent of the Chicago Great Western, and it is reported he will accept an important position with an Eastern road.

Mr. F. H. Keeshen has been appointed superintendent of the Northern division of the Kansas City, Pittsburg & Gulf (headquarters at Pittsburg, Kan.), vice Mr. W. A. Williams, resigned.

Mr. Oscar Otto has received the appointment of general foreman of the Chicago shops of the Chicago & Northwestern Railway. Mr. Otto leaves a similar position on the Rio Grande Western.

Mr. C. P. Coleman, formerly general storekeeper of the Lehigh Valley Railroad Company, has resigned to accept a position of purchasing agent of the Bethlehem Iron Company, South Bethlehem, Pa.

Mr. Jos. Longstreth has resigned as road foreman of engines with the Norfolk & Western at Bluefield, W. Va., to accept a position as master mechanic with the Schoen Pressed Steel Company, of Pittsburg, Pa.

Mr. C. H. Beggs has been appointed purchasing agent of the St. Louis & San Francisco, in addition to his former duties as secretary to the vice-president and general manager; headquarters at St. Louis, Mo.

Mr. George W. Twining, division superintendent of the Central of New Jersey, at Mauch Chunk, Pa., has been appointed general agent of the Allentown Terminal Railway, in connection with former duties.

Mr. H. B. Earling has been appointed superintendent of the Prairie du Chien and Mineral Point divisions of the Chicago, Milwaukee & St. Paul (headquarters at Milwaukee, Wis.), vice Mr. E. X. Hastings, transferred.

Mr. J. W. Sherwood, division superintendent of the Toledo, St. Louis & Kansas City, at Frankfort, Ind., has been promoted to the position of general superintendent, with headquarters at Toledo, O., succeeding Mr. A. W. Mills, resigned.

Mr. Frank Slater, general foreman of the Chicago & Northwestern shops, at Chicago, has been promoted to the position of master mechanic of the Peninsula division of the same road, with headquarters at Escanaba, Michigan—a promotion well deserved.

Mr. E. X. Hastings, superintendent of the Prairie du Chien and Mineral Point divisions of the Chicago, Milwaukee & St. Paul at Milwaukee, Wis., has been appointed superintendent of the Superior division of that road at Green Bay, Wis., vice Mr. R. R. Minturn, deceased.

Mr. Raymond Du Puy has been appointed general superintendent of the Chicago Great Western, vice Mr. C. Shields, resigned; headquarters at St. Paul, Minn. Mr. Du Puy was for some years general manager of the St. Paul & Duluth, and was highly popular with everybody connected with the road.

At the annual meeting of the Suffolk & Carolina Railway the stockholders re-elected the directors of last year, and they in turn elected the following officers: Wm. H. Bosley, president; C. H. Tilghman, vice-president; W. B. Oliver, treasurer; Jno. S. Gittings, secretary; Geo. L. Barton, general manager.

Two new divisions have been created on the Oregon Short Line, viz., Utah division, of which Mr. W. J. Tollerton, heretofore division foreman, has been appointed master mechanic at Salt Lake, and the Idaho & Montana division, of which Mr. D. J. Malone has been appointed master mechanic at Pocatello.

The Westinghouse Electric and Manufacturing Company has just opened a new branch office at Austin, Texas. Mr. J. E. Johnson will have charge of the office and of the further extension of Westinghouse business in the Southwest. The large contracts which this company has been handling in Mexico and the Texas region have led to the establishment of this new center of electrical trade.

Appointments on the Chicago, Milwaukee & St. Paul have been announced as follows: Mr. A. J. Earling, second vice-president and general manager, has relinquished the position of general manager, and will be succeded in that position by Mr. W. G. Collins, heretofore general superintendent at Chicago; Mr. H. R. Williams, assistant general superintendent has been appointed general superintendent, and is succeeded at Minneapolis by Mr. W. J. Underwood.

The following changes have been made on the Grand Trunk Railway: Mr. J. W. Harkom has resigned as master mechanic of the Eastern division, and Mr. Thos. McHattie has been appointed acting master mechanic, with headquarters at Montreal; Mr. A. A. Maver has been appointed locomotive foreman at London, vice Mr. McHattie, promoted, and Mr. W. Turnbull has been appointed repair shop foreman at Toronto, vice Mr. J. McGrath, promoted to erecting shop foreman at Stratford, vice Mr. A. A. Maver, transferred.

Several important official changes have taken place among the officers of the Vanderbilt roads since we last went to press. Mr. Chauncey M. Depew has been made chairman of the Board of Directors of the different roads, and Mr. Callaway, president of the Lake Shore, has been chosen to fill Mr. Depew's place on the New York Central. Mr. W. H. Newman, of the Great Northern, has been chosen for president of the Lake Shore, succeeding Mr. Callaway. Owing to protracted ill health, Mr. H. Walter Webb has resigned the position of vice-president of the New York Central. Mr. J. M. Toucey, general manager of the New York Central, is performing the duties of third vice-president.

Mr. W. H. Newman has been selected for the presidency of the Lake Shore & Michigan Southern Railway, to succeed Mr. Callaway, who goes to the New York Central. The next meeting of the directors of the Lake Shore will be held on May 4th, and Mr. Newman will be elected at that time. He has been for some time second vice-president of the Great Northern, having gone there from the Chicago & Northwestern, where he held the office of third vice-president for six or seven years. Mr. Newman was born in Virginia, and entered railway service in 1869 in the operative department. He went through the positions of station agent, general freight agent, and he rose to be traffic manager of one of the Gould lines, and then was advanced to be third vice-president, a position he left to go to the Chicago & Northwestern. The selection of Mr. Newman is considered the advancing of one of the Vanderbilt railroad officials.

Mr. G. R. Joughins, superintendent of motive power of the Norfolk & Southern, at Berkley, Va., has resigned to accept the position of mechanical superintendent of the Intercolonial Railway of Canada. We are rejoiced to learn of Mr. Joughins' good fortune in rising from a small road to a comparatively large one, and we feel that he will, on returning to Canada, reflect credit on the experience he has gained on a railroad in the United States. Mr. Joughins had originally an English engineering training. He came to Canada some fifteen years ago and rose to be master mechanic of the Huron & Erie in Ontario. He left that to go to the Norfolk & Southern, where he has made an enviable record. Besides being an excellent mechanical engineer, Mr. Joughins is a fine speaker, and no one of late years has been listened to more attentively at master mechanics' conventions and railroad club meetings. Besides having a good command of the Queen's English, he always has something to say which is worth listening to.

We received, some time ago, two postal notes from India that were evidently intended to pay subscriptions for LOCOMOTIVE ENGINEERING. We learn from the Post Office authorities that one was from H. J. Norris and the other from Secretary D. H. H Institute, but they cannot inform us anything about the addresses of the parties, nor can we find them in any of the railroad official lists. We are afraid that letters of advice respecting the notes must have got accidentally destroyed in transit. If any of our readers in India can inform us of the addresses of these two parties, we would be obliged for the information.

EQUIPMENT NOTES.

Two passenger cars are being built for Lake Superior & Ishpeming Railway, at Pullman's.

The Missouri Car and Foundry Company are building twelve freight cars for the Oahu Railway.

Schenectady has order from the Interoceanic Railway for eight engines, part consolidation, part ten-wheelers.

The Richmond Locomotive Works are building eight Consolidation engines for the Southern Railway.

The Southern Pacific Railway Company are having 150 freight cars built by the Barney & Smith Company.

The Schenectady Locomotive Works are building one eight-wheel locomotive for the St. Joseph Stock Yards.

The Baldwin Locomotive Works are building one six-wheel connected engine for the National Docks Railway.

The Colorado & Northwestern Railway is having two eight-wheel engines built at the Brooks Locomotive Works.

The Schenectady Locomotive Works are building a six-wheel connected engine for the Chicago & Northwestern Railway.

Ten freight cars and two passenger cars are under construction at the St. Charles Car Works, for the Louisiana & Northwest Railroad.

The Brainerd & Northern Minnesota Railway Company have given the Richmond Locomotive Works an order for two 50-ton moguls. They are to be identical, except one will be simple and the other a compound.

During the past two months the Baltimore & Ohio Railroad Company has received 1,110 new box cars, 1,239 double hopper gondolas and 224 coke cars of the order of 5,150 recently placed. Deliveries are being made as rapidly as the cars are completed.

The Baldwin Locomotive Works, of Philadelphia, Pa., have recently delivered to the Baltimore & Ohio Railroad Company the last of the large order of locomotives placed last fall. This delivery included twenty heavy engines, which are now being broken in for service between Cumberland and Baltimore. These locomotives are of the same style that the motive power department adopted as the standard for the First and Second divisions. They are of the Consolidation type, with 21 x 26-inch cylinders, and the average load that they pull approximates 1,800 tons.

We are informed by George W. Hoffman, of Indianapolis, whose metal polish has saved firemen much hard rubbing, that his business has increased so much abroad that he has had to open an office at 10 Finsbury Square, London.

Boarding Him In.

Si Slocomb was an engineer on one of the Pennsylvania roads where snow-storms are frequent and where the cabs were boxed in for the comfort of the engineers. The usual way was to board in the whole back of the cab, and then the wood butcher would take his keyhole saw and saw out narrow doors on each side for the engineer and fireman, and curtains would be used to drop down over the opening.

Si hadn't seen this done, but he had asked for it on his engine, and was laying off while it was done.

Now, Si was a machinist runner, and like a good many of them, he wasn't a howling success. He had been into several hind-ends and met with other mishaps, so that he had become expert in "lighting out" of the cab before he struck.

The boss carpenter was a joker from 'wayback, and was always loaded ready to go off at sight.

Si wandered down to the roundhouse just as they had the back-end boarded up, but the doors were not cut through. Si was hot in a minute.

"See here, Jim, why ain't there any doors in the cab, like the other engines?"

"Super's orders," said Jim, soberly.

"Well, I'd like to know why," growled Si.

"Well, I'll tell you, Si—on the quiet—but don't tell anyone. You know you've had several 'run-ins' lately and several jumping matches, and the Super says to me, 'Board him up so he can't jump next time, unless he jumps out the front end.' "

Then Si was mad, and he went straight to the Super, who of course hadn't said anything of the kind, and wanted to know what he meant. He finally cooled down enough to see the joke, and it hung to him for some time.

Automatic Train Checks.

Another train stop has been devised, so that if the engineer gets careless or falls asleep, his train will stop at stations or before danger signals just the same. This time it's a Belgian inventor; but all nations have the same breed. It has been tested in France, and is highly successful. Of course; how many tests of even the "fakiest" contraptions did you ever see that were not "successful"? It's the same scheme as ever—the wheels run over a lever, the lever makes electrical connections or opens an air-brake valve (sometimes one, sometimes the other), and the train stops; then the engineer wakes up and goes on again to the next station.

These work very nicely in models, but few, if any, railroads care to risk the cash outlay, as well as probability of the automatic device failing to "automat" at the proper time. Many of the devices do too much—if they work—and it is often better that they shouldn't work at all.

Some years ago an inventor went to a leading official of the Pennsylvania Railroad with an automatic device that would shut off steam, reverse the engine, apply the brake, sand the rail and do various other things—in fact, it only lacked an attachment to throw the engineer and fireman back into the parlor car to make it complete. The said official looked it over carefully and agreed that it might do all that was claimed, but added, "That would do a d—— sight more damage than the collision." The same can be said of most of these devices, and the question is, how to do the least damage to lives and property.

The best means of prevention that have yet been found are intelligent, well-paid engineers and firemen who have what no automatic device can have—brains and judgment. The inventor or manager who overlooks the engineer as an important factor, is apt to miss his mark.

Safety (?) Gates.

In these days of safety appliances, abolition of grade crossings and other evidences of modern railroading, it is rather surprising to run across a case as shown by the accompanying photograph.

AND THESE ARE CALLED SAFETY GATES.

This was taken recently in one of the cities of this state, with a population of about 15,000 inhabitants, and shows not only a lack of appreciation of good railroading from a business point of view, but also extreme indifference to public safety on the part of the city officials.

It is evidently not of recent date, as the sign seems to be a permanent institution, and is a good example of sign painting—beveled corners, dark border and all.

The object is evidently to save the railroad from damages in case of accident, but the court that would let this stand between the railroad and justice is not worthy the name. It is about equal to the signs reading: "These gates only work between 6 A. M. and 6 P. M."—after that you can hustle for yourself. The sign might just as well read:

> We cannot afford to put gates here. If you get killed it's your own fault. This sign is safer than gates—and cheaper. Look out for the cars.

Notwithstanding the fact that the Bethlehem Iron Company, South Bethlehem, Pa., have on their books large orders for the finished guns of various calibers up to 12 inches, gun carriages and forgings for guns which are to be completed at the various government yards, the number of orders which they are taking for merchant work, such as shafting of various descriptions, both solid and hollow, and of plain steel as well as nickel steel, is increasing daily. The products of this concern have a world-wide reputation, as their taking several contracts for armor plate for the Russian Government proved. Last month they were asked to quote a price on shafting for a Japanese torpedo boat which is being built in Japan. They are the only firm in this country that was asked to compete with such well-known works as Vickers Sons & Co., England; Krupp, of Germany, and Schneider & Co., of France.

The Q. & C. Company report several large orders received for Q. & C. Stanwood steel car steps, two of these being government orders for the steamships Atlanta and Newark. The question of using these goods on passenger coaches is attracting attention among railroad men, as the features they present—strength, durability, economy and cleanliness—commend the goods wherever used. Several roads have put on sample steps and are noting the results given in service. The company are in a position to furnish these steps of any desired dimensions, including special steps for running boards on engines, car steps, ship treads, etc. New supplemental catalog illustrating these goods has just been issued, and will be cheerfully sent on application to the manufacturers, the Q. & C. Company, 700-710 Western Union Building, Chicago.

The pattern storage house at Sacramento belonging to the Southern Pacific was burned down last month, and an almost irreparable loss resulted. The building was fortunately not connected with the company's repair shops, so the destruction did not extend to them or put them in danger.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Air-Brake Convention Items.

President, C. P. Cass.

Next convention, Detroit, Mich.

One hundred and fifteen members answered roll call.

One bright, conspicuous feature of the convention was the presence of so many ladies.

Seventy-nine new members have joined since the Nashville convention, thereby placing the number now enrolled at 355.

Of the 355 members, several reside in Canada, one in Mexico, one in South America, and the remainder in the United States.

The corridors of the hotel were packed late every evening with members exchanging reminiscences and new experiences.

The healthy condition of the association is shown by the treasury balance of $974. Although not quite up to last year's figure, still it is a creditable showing.

The impromptu dance and musicale given in the hotel parlors, Tuesday evening, was enjoyed by all, and showed the surprisingly large attendance of ladies.

Were the supply men there? To one acquainted with their familiar countenances a strong suspicion would arise that they were, and that none had been lost in transit.

General Manager Hutchinson, of the P. R. R., made himself and road popular with the air-brake men by running special cars to Washington for the members and their friends.

An air cylinder worn 1-32 inch larger at the ends will pump 6 per cent. more air if new rings are placed in the piston head, and 33 per cent. more if the cylinder is rebored and new rings fitted.

Shop men are gradually becoming friendly to the engine truck brake. Road men, however, have all along befriended it, seeing its value in preventing those slow tail-end collisions that occasionally occur.

Association members and others desiring copies of the photograph taken of the convention group can obtain same by writing the photographer, Mr. G. de J. Mesny, 226 North Charles street, Baltimore, Md., who will send the pictures C. O. D. by express. Price $1.50 each.

"Nick" Johnson, of the W. A. B. Co., and a charter member of the association, claims to be the oldest air-brake man in the country, having worked with Mr. Geo. Westinghouse while developing his first air brake in the old Pan Handle shops, Pittsburg, in 1869.

While some of the reports and discussions were excellent, as usual, yet it is apparent that the work as a whole was hardly up to the standard of former years. A liberal dose of the Oil of Hustle is needed. The slogan of every member should be: Hustle, and hustle hard.

The unanimous election of C. P. Cass to the presidency of the Air-Brake Association is a most fitting recognition of that gentleman's ability as a presiding officer, as well as a substantial reminder that the members have not forgotten the debt they owe him for valuable services rendered in an "emergency" three years ago in St. Louis.

Many complimentary words were said of the handsome souvenir vest-pocket note-book distributed by LOCOMOTIVE ENGINEERING. The cover is made of white celluloid. On the front is a miniature picture of the front cover of the paper, while on the back is a full-size reproduction in gold of the bars and pendant badge of the association.

One of the most prominent features of the convention was the commendable part taken by the Plant System in sending representatives to Baltimore. General Superintendent Dunham selected a man from each of the twelve divisions of his road, and sent the party from Savannah to Baltimore in his private car, provisioned and manned for a ten days' trip. A photograph of car and party appears elsewhere in this department.

The Air-Brake Association's endorsement of the M. C. B. code of recommended practice for testing triple valves may at first seem superfluous; but when it is recollected that air-brake men come daily in contact with brakes made good or bad by this code, the full significance and value of such endorsement will be appreciated. No one knows the needs of the patient better than the skilled doctor who daily treats him.

A good story is told of H——, a prominent member from C——, who snores frightfully. H—— was in lower berth 7 in a sleeping car en route to the convention, sound asleep and snoring like a pirate. An unfortunate traveling man in the opposite berth 8 rolled and tossed, unable to sleep for the sonorous, buzz-saw sounds coming from H——'s berth. In vain were loud, uncomplimentary remarks passed on the hapless sleeper. Shoes hurled into his berth failed to produce the desired effect.

"For heaven's sake, porter," called the exasperated drummer, "wake up that thunder factory and have it turn over."

"I dun try wake um twice, sah, but no use. Him sleep pow'ful soun', sah," replied the porter.

Just then from lower 7 came a sound like the lining of the snorer's throat ripping loose. H—— had choked and waked himself up. Then, as the snoring ceased, a weary voice from lower 8 murmured, "Thank heaven, he's dead."

THE AIR-BRAKE CONVENTION.

FIRST DAY.

OPENING OF THE CONVENTION.

The fifth annual convention of the Association of Railroad Air-Brake Men convened at Dushane Hall, Baltimore, Md., on Tuesday morning, April 12th.

The opening hour was graced by the presence of a goodly contingent of ladies, who occupied the rostrum near the presiding officer. While the convention was composed of men whose vocation is most peaceful, the fact that the hall was embellished with numerous American flags, pictures and war relics (it being a Grand Army rendezvous), and the fact of present complications in Cuba, the military sentiment was suppressed, and everyone was in readiness to put forth every effort to maintain the reputation for business that their past record has earned.

PRESIDENT'S ADDRESS.

At 9.15 the gavel dropped, the meeting came to order, and President McKee proceeded to read his address. Roll-call was dispensed with. That the association is in good physical condition is evident from its rapid growth. One year ago it had 276 members, and now 355 members.

The address advocated one hour each day to be devoted to topical discussions. A special committee was recommended to consolidate reports. The past year had been uneventful in air-brake circles. The paper of R. A. Parke regarding increased brake efficiency by a proper angle of hangers was favorably commented on. Brake slack adjusters had become established in service on a practical scale. The only new brake devices brought out during the year were a brake valve by the New York Company and the Nellis-Hutchins air-pressure semaphore gage. As the duties of inspectors had been increased by adding steam-heat apparatus, etc., it was suggested that it would be well to include these in the discussions of the convention. The growing tendency of members to bring their wives and families to the convention was alluded to as most wise and beneficial. At the conclusion of the address the fifth annual convention was declared open and ready for business.

The second and third orders of business were dispensed with.

The fourth order of business, that of reading of reports of the secretary and treasurer, was deferred until later, to provide time for members to interview the secretary regarding dues for the coming year.

APPOINTMENT OF COMMITTEES.

The following committees were appointed:

Constitution and By-Laws—C. C. Farmer, M., K. & T.; G. R. Parker, St. P. & D., and E. W. Pratt, C. & N. W.

Subjects—F. M. Nellis, J. L. Andrews, N. Y., N. H. & H.; J. K. Lencke, Q. & C. Co.; T. A. Hedendahl, U. P.; J. R. Alexander, Penna. R. R.

Thanks—F. A. Lane, *Railway Age*, W. P. Huntley, C. & O.; R. H. Blackall, D. & H. C. Co.

REPORT OF COMMITTEE ON "THE ENGINE TRUCK BRAKE AS AN AID IN TRAIN STOPPING."

There being no new business, the reports of committees were in order. The first paper presented was by E. H. De Groot, Jr., C. B. & Q., entitled, "The Engine Truck Brake as an Aid in Train Stopping."

The principal points brought out were "that all the wheels under every vehicle, and the locomotive comprising the train, should, when the brakes are applied, exert a uniform degree of retardation proportional to the weight which they bring upon the rails," and it is this idea which brings up the consideration of the locomotive truck brake.

The importance was urged of being provided with all available facilities to make the quickest possible stop. The importance of the engine truck brake in suburban service was cited, particularly with the heavy engines and light coaches so frequently employed. Statistics were furnished to show that in this service every second saved in stopping has a considerable influence in coal consumption. The point was made that brake apparatus is a necessary auxiliary to safe train service, even though more expensive than hand brakes, and that real conditions of service actually demand the quickest and most powerful acting practical brake, and the engine truck brake is a very considerable factor and easily utilized.

In freight service the engine truck brake also proves of much utility, far greater than a freight car, the maximum braking force being available at all times, while with the freight car the percentage of the brake force decreases as the load is increased over the light weight of the car.

DISCUSSION OF THE PAPER.

Mr. T. A. Hedendahl, U. P. Ry., commended the paper.

M. J. R. Alexander, P. R. R., thought the subject matter well covered. So far as his road was concerned, the results from using engine truck brakes were very satisfactory. He referred to the tendency of hot tires on long grades with 70 per cent. brake force.

W. P. Huntley, C. & O., commented favorably on the truck brake of the one engine on his line.

Several other members spoke, the consensus of opinion being that the engine truck brake was valuable as a braking adjunct. S. D. Hutchins, W. A. B. Co., declined to talk on the subject, having had no opportunity to study the paper, and urged the importance of sending in papers to Press and Printing Committee early, that they might be supplied to members in advance.

It was stated that shop men found the engine truck brake an obstruction when doing work on the truck, also out on the road when hot journals demanded attention.

The committee was congratulated on their able paper, they having been put in charge of its preparation but a short time previous to the meeting.

It was quite apparent that such objection to the engine truck brake as is usually offered is a result of prejudice, and wears away as the brake becomes familiar to those coming in contact with it.

Paper adopted as read.

CONVENTION HOURS AND TOPICAL DISCUSSIONS.

It was moved, seconded and carried that the convention hours be from 9 to 1 o'clock daily, and that the hour from 12 to 1 o'clock be reserved for topical discussion.

PAPER CARRIED OVER.

The paper on "The Value of the Equalized Form of Driver Brake as Compared with the Cam Type" not being ready, it was suggested that it be continued until the next convention.

PISTON TRAVEL, MEANS OF ADJUSTMENT, ETC.

The next paper read was by Mr. E. W. Pratt, C. & N. W., the subject of which was "Piston Travel, Means of Adjustment and its Effect Upon the Handling of of Trains." The paper was replete with good suggestions, giving numerous reasons why piston travel must be adjusted, explaining total leverage, the inefficiency of hand adjustment, the terms "standing travel," "running travel," "lost travel," "false travel," "shoe clearance," "angularity of levers," etc.

It took issue with the assertion that the proper brake adjuster would let out as well as take up slack, spoke of varying piston travel from hand adjustment, and stated that it remained for the automatic adjuster to practically solve the question by doing away with all limits by adjusting at specified running travel.

Variation in piston travel in long trains was cited as producing shocks, more or less severe.

Practical tests had demonstrated that a brake adjuster resulted in about 50 per cent. greater braking force on an average than hand adjustment.

The practice of figuring average piston travel in a train was deprecated, as with this method an ideal piston travel could be obtained with a seven-car train, four cars having 4 inches travel each, and three with 11 inches travel each, yet an average of 7 inches would be had.

After pointing out the numerous troubles and difficulties in maintaining proper piston travel, and the undesirable results from its lack, the paper concludes that these difficulties can only be overcome by using an automatic adjuster.

DISCUSSION OF THE PAPER.

Messrs. F. B. Farmer, Alexander, Willet, Desoe, Best and others, spoke on the subject and one point of interest prominently mentioned was the desirability of slack adjusters for freight cars.

The argument that fairly good results could not be obtained with freight trains of varying piston travel, was questioned though it was conceded that on trains with adjusters better brake handling was possible.

Mr. H. S. Kolseth, W. A. B. Co., brought up the question of piston travel for driver brakes, he contending that the best method of determining proper travel was by resorting to a gage on the cylinder or reservoir to know the equalizing pressure.

Mr. S. D. Hutchins, W. A. B. Co., moved, and it was seconded and carried that the paper be carried over to the next session, the hour having arrived for topical discussion.

TOPICAL DISCUSSION.

The first fifteen minutes of topical discussion was a continuation of the discussion of the paper on slack adjusters.

The next subject was best lubrication for driver brakes, when cylinders are located near the firebox. Kent's compound was both recommended and questioned.

In connection with this subject the removal of jacket and lagging from cylinders, placing non-conducting material and having air space between cylinders and firebox, turning packing leathers half round, metallic in lieu of leather packing, etc., were suggested.

Mr. S. D. Hutchins described a simple and convenient arrangement in use on the N. Y., N. H. & H. R. R. for testing driver brake cylinder and train air signal

(*Continued on page 239.*)

C. P. CASS, President.

W. F. BRODNAX, First Vice-President.

R. H. BLACKALL, Second Vice-President.

T. A. HEDENDAHL, Third Vice-President.

P. M. KILROY, Secretary.

OTTO BEST, Treasurer.

PRESENT OFFICIALS OF AIR BRAKE MEN'S ASSOCIATION.

pressures. A pipe connects the cylinder and signal line. This pipe has two cocks with a provision for attaching a gage between them. By opening one of the cocks, the gage is in connection with signal line. By closing this cock and opening the other the brake cylinder pressure is registered on the gage.

It was voted that the members and ladies be photographed.

Mr. S. D. Hutchins stated that the Pennsylvania Railroad Company had tendered a special train to take the members and their friends to Washington Friday morning. Adjourned to meet 9 A. M. Wednesday.

PLEASURE TRIPS AND GATHERINGS.

Tuesday afternoon many of the members and ladies availed themselves of the opportunity to visit the government Fort McHenry and the Cambria Iron Works.

A street-car ride of some four miles was taken, during which many things of interest along the route were noted. The objective point was reached, where the company passed a pleasant hour, then returned to the hotel.

In the evening an impromptu musical entertainment was given in the hotel parlors, attended by many members and ladies; another contingent meantime visiting various points of interest about the city.

SECOND DAY'S SESSION.

The second day's proceedings opened at 9.15 Wednesday, the number of members present having been heavily reinforced by the late arrivals.

INVITATIONS.

S. D. Hutchins extended an invitation from Manager Forsyth, of the "International Correspondence Schools," to the members to visit their private car at Baltimore and observe the practicability of their system of teaching, the invitation subsequently being acted on by many of the air-brake men.

The announcement of an invitation from General Superintendent of Motive Power Middleton, of the Baltimore & Ohio Railroad, to visit the general shops of his road at Mount Clare, Md., at the convenience of the members, was received with much interest, and the large number who inspected the shops were more than pleased with their cordial reception and the numerous objects of interest to be seen on every hand.

DISCUSSION ON SLACK ADJUSTERS CONTINUED.

The first subject of discussion was a continuance of the paper on slack adjusters, Messrs. Pratt, Hutchins, Lencke, Haverstick and Desoe taking part; after which the discussion was closed.

BEST METHOD OF LOCATING AND REPAIRING DEFECTS ON TRAINS EN ROUTE.

The next paper presented was by Mr. I. H. Brown, C. & O., on the subject, "Best Method of Locating and Repairing Defects on Trains en Route," the paper being confined to car brakes alone.

The paper was largely in the nature of instructions, the following points of interest, among others, being dwelt upon: That train men should stop leaks where possible, make necessary brake tests, adjust piston travel when inspectors are not present, and invariably report existing defects which they cannot remedy.

It presented and discussed an air-brake defect card, comprehending those features of the M. C. B. card deemed best, with such additions as seemed to be required, and recommending that it be of light-blue color and thereby readily distinguishable.

It was the committee's belief that on roads having any considerable grades it is often possible to employ the most reliable of all tests, that of the comparative temperature of wheel treads, the examination to be made immediately or soon after brakes had been used to hold the train down grade.

The different train-pipe leaks were considered and methods of correction given, as well as wrong piston travel, sticking brakes, bursted hose, best manner of remedying defects, replacing defective coupling packing rings and wheel sliding. The paper concluded by giving the quite numerous possible reasons for hot and cold wheels after continued brake application.

DISCUSSION OF THE PAPER.

Following the presentation of the very able paper was an exhaustive discussion.

Mr. C. C. Farmer suggested an addition to defect card to show whether defective triples gave service or emergency application, and advocated spare signal hose, with train-pipe air couplings, that signal line might be utilized in lieu of train pipe under a car when the latter was rendered useless from any cause out on the road.

Mr. R. F. McKenna advocated the use of nipples in train line in near proximity to angle cock to facilitate repairs when train pipe is broken at the back end of the angle cock.

Mr. Alexander, Penn. R. R., gave a number of reasons for opposing the use of defect cards, explained the Pennsylvania Railroad method of reporting defects, questioned the reliability of the wheel-temperature test, and thought coupling packing rings should be renewed at designated points on the road, rather than to have them renewed by train men while train was en route.

Messrs. Hedendahl, Parker, Blackall, Haverstick, Best, Willit and others took part in the discussion, the defect card being the predominating feature. The consensus of opinion expressed was largely in its favor.

At the closing of the discussion the committee was warmly commended and received the thanks of the convention. Paper adopted.

At this juncture Angus Sinclair was called on for a speech, and responded in his usual inimitable vein. He related some early British railway reminiscences and later ones on American roads; his first experience and impressions of the Westinghouse air brake on a locomotive; early interest in air brakes, particularly the air pump. He finished by impressing upon his hearers the importance of keeping familiar with the different devices and improvements, and to beware of becoming rusty in matters pertaining to such important mechanism.

E. A. Phillips, *Railroad Car Journal*, was called up, and in response said that extemporaneous speaking and writing were vocations of a decidedly dissimilar character; but he proved to his auditors that he was equally able to do both. Among other things he said was that he greatly respected men who could talk air brakes. He spoke of the progress made by the association, compared it very favorably with the older railroad organizations, and closed by remarking the vast responsibility of the air-brake men, upon whom largely depended the profit or otherwise on the thirty or forty millions of dollars invested by railroads in air-brake equipment.

EFFICIENCY OF AIR PUMPS.

The topical discussion to follow was dispensed with, and a paper on "Air Pumps" was read by W. H. Young, L. & N. The paper was largely a statement of results of tests conducted to determine the efficiency of pumps in different degrees of condition, and to show the wear of all the different parts of the 8-inch pump. A mass of figures on pressures, wear, heat, efficiency, etc., was presented; also capacity at different speeds of both old and new pumps, and comparative results, and the efficiency of pumps with different sizes of discharge pipes.

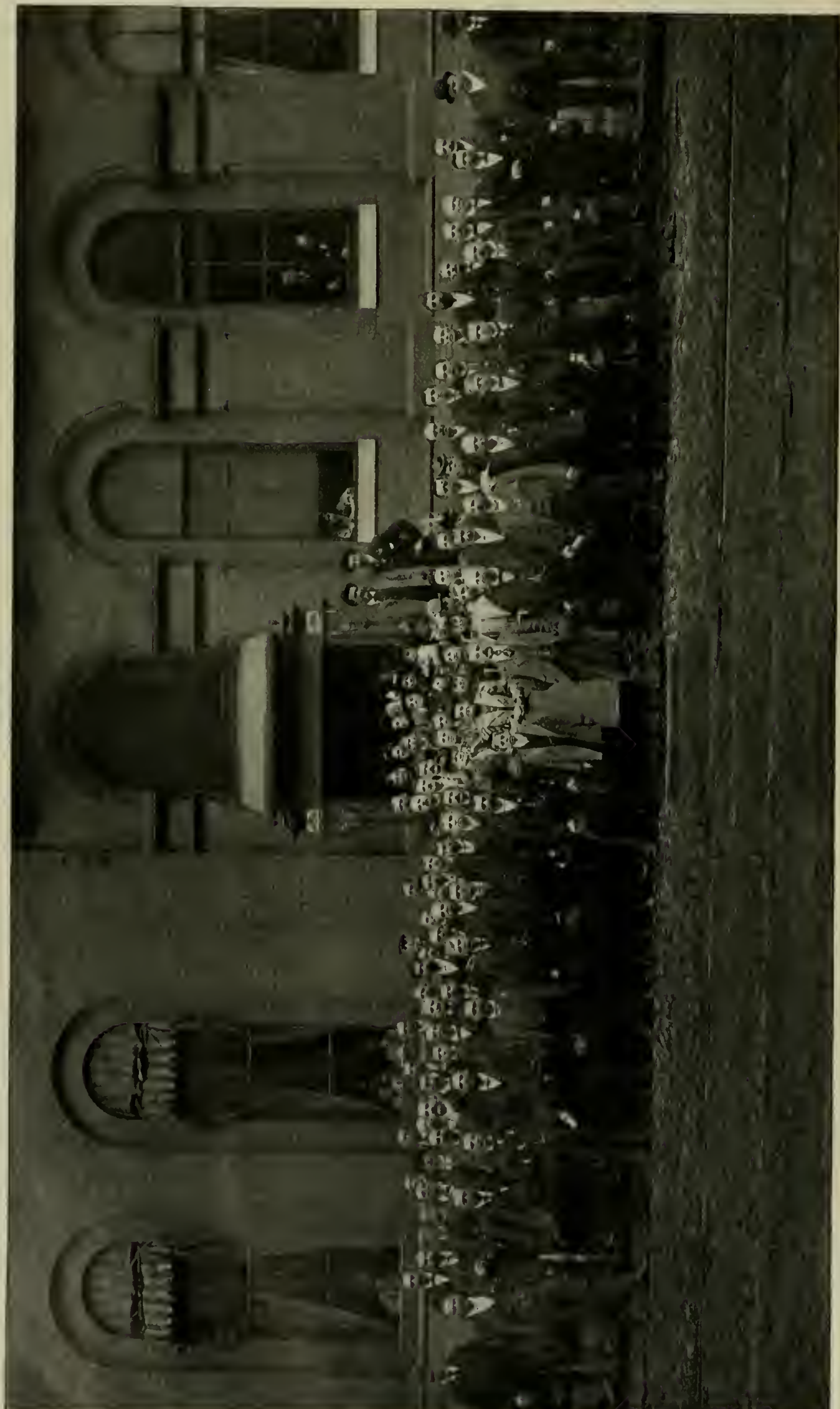
F. M. Nellis, Locomotive Engineering, followed, and gave some very interesting data on the subject. An air pump with worn air cylinder and worn piston packing rings was taken in shop and fitted with new packing rings, thereby pumping 6 per cent. more air. The cylinder was then rebored, new packing rings fitted and the efficiency of the pump was increased 33 per cent.

S. D. Hutchins proposed that, owing to the complicated data, the paper be printed in this year's proceedings, and discussed next year, thereby giving members an opportunity to familiarize themselves with its contents, the suggestion receiving the approval of the convention.

Some desultory discussion was then indulged in, and at the appointed hour adjournment for the day took place.

No special recreation had been planned for the remainder of the day and the members and ladies, therefore, enjoyed

(Continued on page 241.)



PEOPLE AT AIR BRAKE MEN'S CONVENTION.

themselves about the city in such manner as best suited their fancy. Many members availed themselves of the opportunity to take a trip through the Baltimore & Ohio tunnel on the electric locomotives.

THIRD DAY.

ROLL CALL.

The third and final day of the convention opened at the usual hour, with a most satisfactory attendance, all of the stragglers having reached camp. The roll call showed 123 members present.

REPORTS OF THE SECRETARY AND TREASURER.

The report of the secretary was cheering as it related no deficiency, but a balance of $974 to the credit of the association. The treasurer's report came with the additional information that the cash was secure.

The report of Committee on Constitution and By-Laws was deferred until after the election of officers and designation of place for holding the next annual convention.

REPORT OF COMMITTEE ON THANKS.

The report of Committee on Thanks came next in order, and gratitude was expressed to all railroad officials and others who had in any way contributed to the comfort, pleasure and assistance of the convention and its members.

It was unanimously voted to telegraph to Mr. John W. Thomas, Jr., Assistant General Manager of the Nashville, Chattanooga & St. Louis Railroad, the thanks of the association for the almost endless favors extended to its members at the time of meeting in Nashville, Tenn., last year, this being the first opportunity to do so as a body since that time.

DETROIT SECURES THE NEXT CONVENTION.

A number of invitations were read from parties desirous of having the next convention held in their respective bailiwicks, after which the following cities were placed in nomination: Detroit, St. Louis and Cincinnati. One ballot only was required to settle the question, Detroit being chosen as the place for holding the 1899 convention.

REPORT OF COMMITTEE ON SUBJECTS.

The report of committee on subjects for next year was as follows: "High-Speed Brake," "The Organization, Duties and Management of the Air-Brake Department," "Recording Gages for Air Pressures," "Repair Track Repairs for Cars," "Breaking Apart of Trains and Best Method of Preventing Same," "Air Gages for Air Signal and Driver Brakes," "Steam Heating of Passenger Equipment."

Otto Best urged the importance of having good subjects, and of a character to appeal to the members, as such a course has no small bearing on the disposition of association publications. The report of committee on subjects was accepted.

Messrs. Nellis and Pratt strongly urged the importance of every member lending his aid to the several committees and sending information in early. Mr. Nellis also cautioned the members not to feel too secure because the association was now on the wave of prosperity, but that constant effort on the part of all was essential to maintain the present standing.

TOPICAL DISCUSSION.

Topical discussion was next in order. The opening discussion was on the subject of triple-valve repairs.

G. S. Hale enquired what method of testing was best to detect leaky triple piston packing rings. C. C. Farmer, J. R. Alexander, M. Marea, J. Paul and R. McKenna each advanced different methods of conducting the packing-ring test. T. Cope, in reply to R. H. Blackall, stated the practice of testing by the Westinghouse Air-Brake Company at their works.

F. F. Coggin, B. & M., desired information regarding the number of different types of triple valves at present in service, stating that of his own experience he knew of nineteen.

Otto Best looked upon this non-uniformity of triple valves as a most vital question for the consideration of the Air-Brake Association, as he had had experience with all these various types of triple valves, and even others, and had had trouble from their non-uniformity. He made a motion, which was seconded and carried unanimously, that the M. C. B. code of recommended practice of triple-valve tests be endorsed and adopted as the standard of the Air-Brake Association.

ELECTION OF OFFICERS.

The next order of business was the election of officers.

Otto Best nominated C. P. Cass, St. L. & S. F. Ry., for president, the nominations being then closed. It was moved and seconded that the secretary be directed to cast the vote of the convention for C. P. Cass, and the motion was unanimously carried.

The first, second and third vice-presidents were renominated and elected to succeed themselves.

P. M. Kilroy was re-elected secretary, and Otto Best, treasurer.

Frank Cross, Plant System, was elected the third member of the Executive Committee.

MISCELLANEOUS DISCUSSIONS.

The subject of dead Air-Brake Association timber was next disposed of, and the constitution was changed, giving the secretary discretionary power to drop members two years in arrears for dues, no gratuitous air-brake literature to be furnished such members after that time.

Animated discussions on general topics of a very interesting character were next indulged in.

The Auditing Committee reported finding the reports of the secretary and treasurer correct.

CONVENTION ADJOURNS.

A vote of thanks was given the retiring officers of the association for services rendered. There being no further business, the convention adjourned to meet in Detroit, Mich., the second Tuesday in April, 1899. After adjournment an immediate scattering of members took place. Quite a large contingent departed for Washington, in special cars tendered by the Pennsylvania Railroad, most of the others heading in various directions for their respective homes.

CORRESPONDENCE.

Testing for Train Pipe Leaks.

Editors:

In your April issue I note that A. W. Collins, of Meadville, Pa., and C. F. Hammond, of the T., St. L. & K. C. Ry., object to statements in the February number made by me in regard to testing for train-line leaks. Confession is good for the soul, it is said, and I must confess that I do not agree with these gentlemen in regard to their ideas on the subject.

Mr. Hammond supposes a case in which a 5-pound reduction has been made and the engineer's valve placed on lap. If the black hand continues to fall, he says, it is caused by little drum pressure leaking by the packing ring of the equalizing piston to equalize with the reduced pressure in the train line caused by a leak. So far we agree perfectly, and this is the practice I advocate. He then goes on to say that there is not an engine on his road that will do this. The gentleman is certainly speaking from theory rather than practice, and the following is my reason for making the assertion:

I have taken twenty-five engines, in all kinds of service, equipped with valves that have been in service from one week to two years, and there was not a single instance in which, after the valve was lapped, the black hand would not gradually fall and register train-line leakage. I must say that I was surprised to see the leakage registered by the black hand as quickly as it was. This was a practical test, and not a theoretical idea. Mr. Hammond assumes that the packing ring forms an air-tight joint between the little drum and train-line pressures when the valve is on lap, and if this ring leaked the equalizing feature of the valve would be lost. Of course, the black hand would not register a train-line leak with the valve on lap if the packing ring were tight; but it is not supposed to be absolutely tight, and is wrong if it is so.

Mr. Hammond recommends to test for train-line leaks by pumping up to full pressure in running position, shutting off the pump and watching the black hand. If it falls, he says it shows a train-line leak. If it falls then, will it represent a train-line leak? Decidedly not. It may be a leak in the little drum, train line or auxiliaries, and the subject under discussion has simply to do with train-line leaks.

Mr. Collum seems to infer that I think that with the valve on lap a train-line leak will immediately be registered by the black hand. I understand perfectly that time is necessary to allow little drum pressure to leak by the equalizing piston packing ring and equalize with the pressure in the train line. It is to be expected erned by the speed of the pump to detect leaks. This is a very good idea if applied to the general condition of the train as regards leaks in the main reservoir, little drum, train line and auxiliaries; but I would again suggest that the question is one of train-line leaks alone. Leaks in auxiliaries release brakes after being applied, and this is a subject within the province of those inspecting the train, and any such defective brakes, and the number of them, should be reported to the engineer.

To those who feel in doubt as to whether the packing ring leaks so as to allow the black hand to register a train-

PLANT SYSTEM DELEGATES AND GENERAL MANAGER DURHAM'S PRIVATE CAR SENT TO THE BALTIMORE CONVENTION OF THE AIR-BRAKE MEN'S ASSOCIATION.

that the pressure in the train line will keep a little below that in the little drum; but the leak will be shown much more quickly, as described in the February Locomotive Engineering, by making a 5-pound reduction and applying the brakes, than to simply lap the valve without applying the brakes.

Mr. Collum, assuming that the packing ring sometimes leaks, further says that the train line may have leaked down 20 pounds after the valve is lapped, and the black hand only show a leak of 5 or 10 pounds. If the black hand showed a leak of 10 pounds, if given a longer time, it would continue to show a further leakage. He considers it better to be gov-line leak when the valve is lapped, I would suggest the following test: Charge an engine and lap the valve. Then open the bleed cock on the tender or driver-auxiliary and watch the black hand. If a case should be found where the leak was not registered, the valve would be a candidate for a thorough cleansing.

Robert H. Blackall,
A. B. Insp., D. & H. C. Co.
Oneonta, N. Y.

Test to Detect Main Line Leaks.

Editors:

An article in February number, by Mr. Blackall, I thought was about right. Mr. C. F. Hammond, however, thinks it is not quite right. The packing rings in equalizing pistons on his road must be unusually tight. I have never seen one that was tight. Have tested a number, and 70 pounds will get by in from 25 seconds to 5 or 6 minutes. I don't like to have them leak too bad, but there is such a thing as their ring being too tight and start hard, giving you quick action, likely, when you do not want it.

If, before he left engine house, Mr. Hammond would test his valve by closing cut-out cock under valve, and found it all right when coupled to train, he would charge up and make a 5-pound reduction, he would find that if the equalizing piston leaks a train-line leak will show by black hand falling.

Mr. Hammond would charge to maximum pressure, shut off pump, and have valve in running position, then if black hand falls, the train line leaks, he says. How does he know but that gasket is leaking?

Main reservoir pressure might be where his leak was, and no matter what was leaking, the black hand would not fall until excess pressure was gone.

I would say, therefore, that by reducing 5 pounds and then lapping the valve, the air in auxiliary will not reduce, and no air can get to train pipe from main reservoir. This, I believe, would be the best way to test for train-pipe leaks.

Nashua, N. H. L. M. Tighe.

Device for Replacing Air Pump Pistons.

Editors:

I am sending you a drawing and description of a device to be used to facilitate replacing the piston rod in air pumps after the renewal of metallic packing.

When metallic rings are renewed, much difficulty is had at times on account of the end of rod catching on the edges of the rings, as shown by arrows *a* and *b*, in Fig. 1. Much time is consumed in getting the rod through to the air end of pump, especially if the pump throttle leaks, and steam and hot water are present.

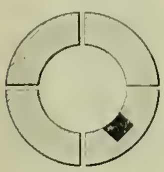


Fig. 3

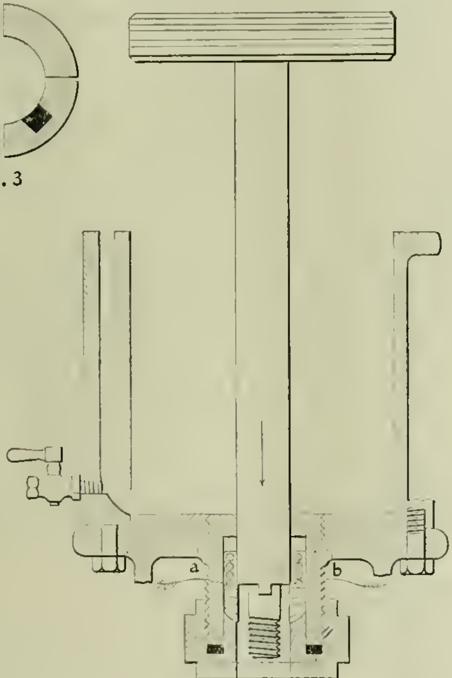


Fig. 1

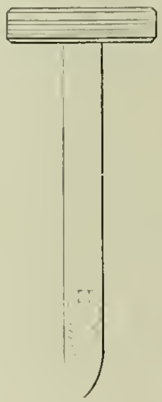


Fig. 4

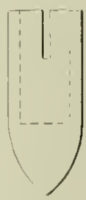


Fig. 2

To avoid this trouble, I fit a cap with a tapering point and the same outside diameter as the rod, as shown in Fig. 2, onto the end of the rod, and I find I can force the rod through both glands and stuffing boxes without any trouble.

The cap is made of brass, bored out to fit the rod, the same as the piston head for the air cylinder, and slits are cut part way down to permit of slight enlargement at that end should it be desired.

Fig. 3 shows the base of the cap, with socket cut to receive the dowel on the shoulder of the rod.

Fig. 4 shows piston rod with cap placed on end ready to be replaced.

H. B. Parrish.

Engr., N. Y., N. H. & H. R. R. Co.

Pittsfield, Mass.

Increasing Air Pump Efficiency.

Perhaps one of the most interesting and instructive features of the year to air-brake men was brought out in the tests on the D., L. & W. Ry., at Scranton, Pa., by the Air-Brake Association Committee on "How to Best Obtain and Maintain a Higher Efficiency in Air Pumps." It is as follows:

An 8-inch pump was taken into the shops, placed on the rack, and record taken of the number of strokes and time required to pump up 100 pounds of air in a main reservoir. New packing rings were then fitted to the piston, and the records taken showed that the efficiency of the pump had thereby been increased 6 per cent. Then the air cylinder was rebored, new rings fitted to the piston, and a still higher efficiency of 27 per cent. was thereby secured. Thus reboring the air cylinder and renewing packing rings raised the efficiency of the pump 33 per cent., while merely fitting new rings into a worn cylinder increased the efficiency only 6 per cent. above that of the pump when taken off the engine into the shop for repairs.

These results are significant, and strongly condemnatory of the usual practice of overhauling a considerably worn pump by replacing worn packing rings with new ones.

The American Brake Co., St. Louis, Mo., has gotten out a new and attractive catalogue of the engine truck and driver brake.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(44) J. G. M., Cleveland, O., asks:

Give size of preliminary and train-line exhaust in 1890 and 1892 model brake valves. A.—5-64 and 9-32 in the 1890, and 5-64 and 9-32 in the 1892 model.

(45) J. G. M., Cleveland, O., asks:

Should thin leather be used as a diaphragm for feed valve? A.—No. Leather is not at all suited to this service. Use only the specially prepared rubber diaphragms furnished by the manufacturer.

(46) J. G. M., Cleveland, O., asks:

In a recent report on "Movement of Air-Brake Cars," the N. C. & St. L. R. R. numbers the brakes from 1 to 5, inclusive. Can you give the names of these five manufacturers? A.—Westinghouse, New York, Boyden, Lansberg and Crane.

(47) J. G. M., Cleveland, O., asks:

Why is equalizing piston required to seat against leather body gasket in 1892 model brake valve? A.—The leather forms a cushion for the piston to strike against. The force of the blow is sometimes considerable, as will be shown by examining the leather where the piston strikes it. The piston does not necessarily make a joint against the leather.

(48) J. G. M., Cleveland, O., asks:

How should rotary valve and seat be faced and packing ring fitted to equalizing piston? A.—The rotary seat should be first faced off in a good lathe or by a well-made facing reamer tool. Then the rotary valve should be placed in the lathe, and a fine cut, with a fine feed, be taken off with a sharp, narrow-nosed tool, and then ground in with oil. Do not use any grinding material. Should the surfaces not be true when taken from the lathe, seat them by scraping with a fine scraper and rubbing up with oil.

(49) J. W. K., Basalt, Colo., writes:

Will a brake shoe hold as much with only half of its surface bearing on the wheel as it would if whole surface bore on it; piston pressure the same in both cases? A.—Generally speaking, no. A brake shoe only half bearing on the wheel is either a new shoe or does not come up squarely to the wheel. In either case, the power applied would not perform the highest possible amount of work. It may be of interest to state that tests have proved that a brake shoe 18 inches long, with a full bearing, produces no greater holding effect than one 9 inches long.

(50) J. A. D., Altoona, Pa., writes:

Do you not think that enginemen running upon red flags or lights between stations—at speed exceeding, say thirty miles an hour—should apply emergency at once? I understand that at high speed the retarding effect of shoes on wheels would not be sufficient to damage draft rigging of cars. A.—The emergency feature of the brake was supplied to stop quickly in emergencies. A flag is certainly considered an emergency. You are right regarding damage to draft rigging from an emergency application at high speeds. It is at low speeds where the damage is done.

(51) J. A. D., Altoona, Pa., writes:

1. A single sleeper was standing on grade with air brakes on. Car inspectors opened valve to water tank to supply water. Brakes released, causing car to roll off. Could this escape of air from water tank cause release of brakes? A.—1. Yes, on certain cars, if the stop cocks between the water tanks and air tanks leaked badly. 2. If the governing valve between auxiliary reservoir and air-storage tank should become gummed or clogged, would not this permit reduction of air in auxiliary under circumstances cited above? A.—2. Not unless assisted by leaking stop cocks, as above stated.

(52) J. A. D., Altoona, Pa., writes:

Several cases have occurred recently where accidents were narrowly averted, and where enginemen were apparently flagged in sufficient time. It appears that engineman of freight train, running thirty to forty miles an hour, after discovering flag, would apply brakes in service, and train not holding up, he would then apply emergency and not obtain any emergency results. Please explain. A.—After the service application has been fully or nearly fully made, the brake cylinder pressure is so high and the train-pipe pressure so reduced as to render it impossible to get train-pipe pressure into the brake cylinder.

(53) R. F., New Orleans, La., writes:

Please explain how it is that in full release position we do not get any excess pressure in the main reservoir, while in the running position we get 90 pounds pressure in the main reservoir and 70 in the train pipe. Also explain the action of the excess pressure spring. A.—In the full release position, with both 1890 and 1892 model brake valve, air passes from the main reservoir to train line through a direct or free port; hence, the main reservoir and train-line pressures must be equal, giving no excess. In the running position, the direct or free connection between the main reservoir and train pipe is cut off, and another different connection made. For a fuller explanation see 91-118 of the Air-Brake Men's Questions and Answers.

(54) T. N., Yoakum, Tex., asks:

1. With the 1890 model brake valve, does the 20-pound pressure valve ever come in contact with its seat after having more than 20 pounds on the reservoir? A.—1. Yes, it is seated at all times, except when admitting pressure to the train line. 2. Is the excess pressure or train-line valve supposed to close when the pump is shut off by the governor? A.—2. While the governor does not cause the act, yet the valve will be found seated at that time. 3. Does train-line governor valve in 1892 model brake valve take its seat when handle of brake valve is put in full release position? A.—3. If the valve was open it will close immediately, providing the train pipe pressure is raised above 70 pounds. 4. Where is the trouble if, in an 1890 model valve, the pressure runs up to the regulation 70 and 90 pounds, and the reservoir pressure has to leak back to 70 pounds before pump will start again? A.—4. The rotary valve leaks, allowing train-line pressure to be maintained at or above 70 pounds. In this valve, the governor is connected to train line; hence the action.

Orders to Remove New York Air Brakes.

On March 30th Judge Lacombe, in the United States Circuit Court, Southern District of New York, issued an order enjoining the Great Northern Railway from further use of infringing New York Air-Brake Company triples. The Great Northern Railway has 16,000 freight cars, 3,200 of which are equipped with infringing apparatus. Judge Lacombe has ordered the removal of 500 of these brakes within sixty days from date of entry of the order. Five hundred more shall be removed every thirty days thereafter until 2,500 shall have been removed, and the remainder shall be taken off at the rate of 250 every thirty days until all infringing apparatus is removed.

The Great Northern Railway Company moved to suspend the enforcement of this injunction, pending appeal, and urged that personal and public inconvenience would be experienced in withdrawing the cars from service for the removal of the brakes. Judge Lacombe, however, denied this motion, but granted forty days' additional time for the removal of the first 500 brakes, saying that inasmuch as the cars were temporarily withdrawn from service to put the infringing apparatus on, it would seem no greater inconvenience to again temporarily withdraw them to take these devices off.

Judge Lacombe decided that when a patent has been repeatedly sustained in the courts, as has been the Westinghouse patent, a preliminary injunction may be issued against the user, especially when he has been notified that he was buying an infringing article, as were both the Buffalo, Rochester & Pittsburg Railroad and the Great Northern Railway, and a patentee who has established the validity of his patent against the manufacturer will not be compelled to fight for his rights against scores and hundreds of users, or denied the only relief which can secure him the fruits of his invention.

During the month of March, over 16,000 sets of freight brakes were manufactured, sold and shipped from the W. A. B. Co.'s works, Wilmerding, Pa.

A New and Popular Appointment.

Mr. J. C. McCullough has been recently appointed to the newly created position of assistant traveling engineer on that part of the P. C. C. & St. L. Ry. lying between Pittsburg and Columbus. For the past eleven years Mr. McCullough has been running a freight locomotive between Pittsburg and Dennison; has a splendid record, is an expert air-brake man, and is equally popular with his daily associates and his officials. While but thirty-two years of age, he carries an old head on young shoulders, and is admirably adapted to the position. That "Jim" will give a good account of himself is not for a moment doubted by his many friends, whom we join in wishing him success.

Portable Bridge Riveting.

Among the other improvements of the New York, New Haven & Hartford is that of renewing and strengthening the bridges on the Northern division, or what was formerly the Boston, Clinton & Fitchburg road. A short, heavy span has been put in place at Leominster, Mass.

Compressed air is now largely used in portable tools for this class of work, and the connections of this bridge were riveted together by one of the machines of the Chicago Pneumatic Tool Company. These riveters are comparatively light (weighing only 120 pounds in this case) and easy to handle, but are strong enough for any portable work.

Air at 90 to 100 pounds pressure was used, and with the machine in question ⅞-inch rivets, 4 inches long, were easily driven. The record for this job was 900 rivets in nine hours, which is very good work indeed.

The Richmond Locomotive Works have recently presented to Purdue University a full-sized model of the front end of one of their two-cylinder compound locomotives, the intercepting valve of which is sectioned so that its operation may be seen. The cylinders are 20 and 30 inches in diameter, respectively, and the saddle is surmounted by a full-sized smoke-box and stock. The whole makes a very complete and impressive exhibit.

The Boston Belting Company have issued a little illustrated circular about a golf ball they are making. Any of our readers who are given to taking exercise on the golf links will do well to send for the Boston Belting Company's circular.

We notice that several of our railroad contemporaries have found out that the railroad department of the *Pittsburg Post* furnishes excellent material for stealing from without credit.

Car Notes from the Long Island.

The new combination cars ordered by the Long Island Railroad some time since are now in service, and deserve all that was said for them at the time the order was noted. They are a handsome vehicle, and with their 36-inch Taylor steel wheels and Standard steel platforms and couplers, are good examples of car design. An improved status of things pervades all matters pertaining to rolling equipment and this is of course in harmony with the policy of the management, to put the road at the top.

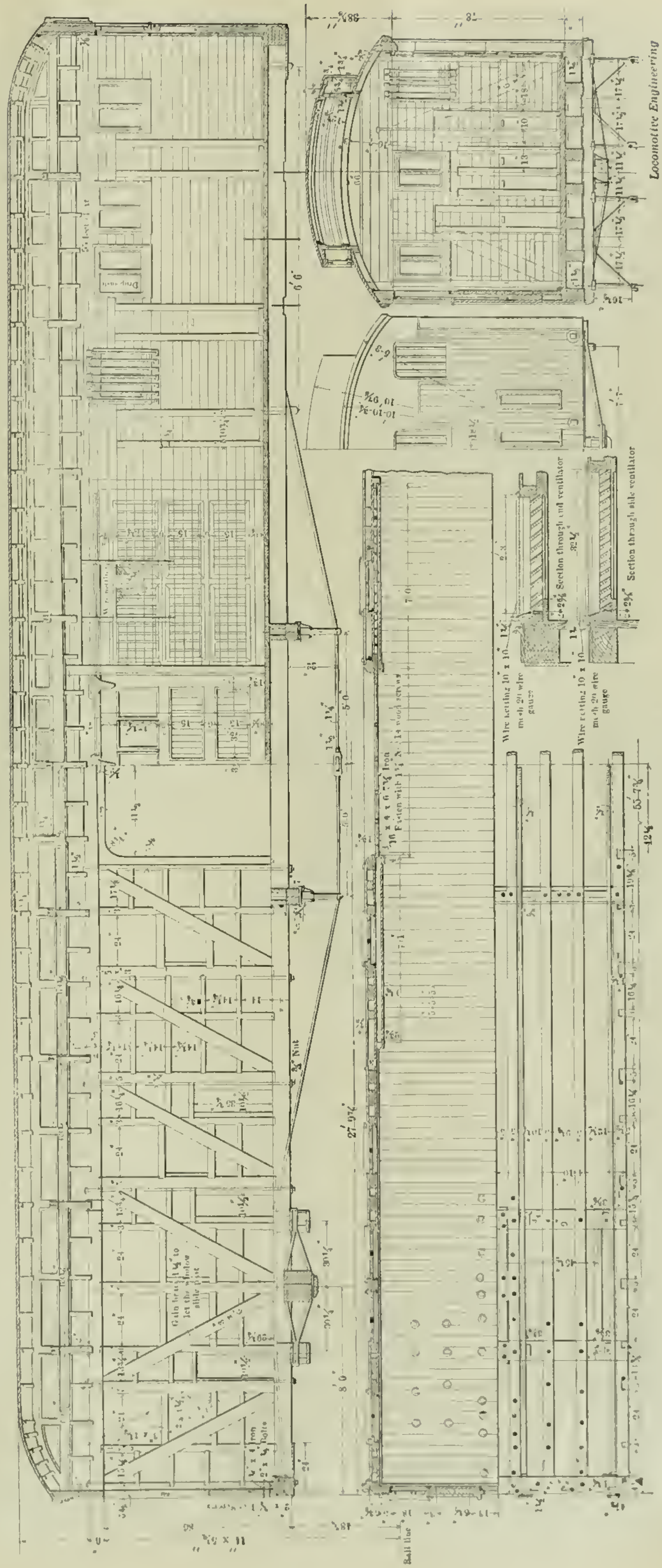
Betterment of the service is the order, and twenty five of the so-called rapid-transit surface cars are being overhauled so as to conform to Brooklyn elevated cars, and run in trains with the later on the elevated system in Brooklyn, but not on the Bridge. The expense involved in this change is no small item, since the platforms and hoods must be remodelled in order to bring them to the design of the elevated equipment. In addition to these changes, the vacuum brake will be applied, the cars thus having two braking systems—air for the surface roads and vacuum for the elevated.

A still further desire to make their service one that will reduce kicks from the public to a minimum, is shown in the fitting up of six cars which are to be devoted to the transportation of bicycles; each car is arranged to carry 142 wheels.

Horse Express Car—Erie Railroad.

The new horse express cars of the Erie Railroad, shown in our illustrations, are a refinement in improved fancy stock transportation that has been practiced by a few roads recently, giving the thoroughbred accommodations of the highest class. These cars are of combination character, being built with the view of utilization in regular express service during periods when not required for the movement of horses; they are therefore built on the general lines of the Erie express and baggage equipment; that is, without platforms and hoods, the notable exception being in the substitution of a six wheel truck for the four-wheel.

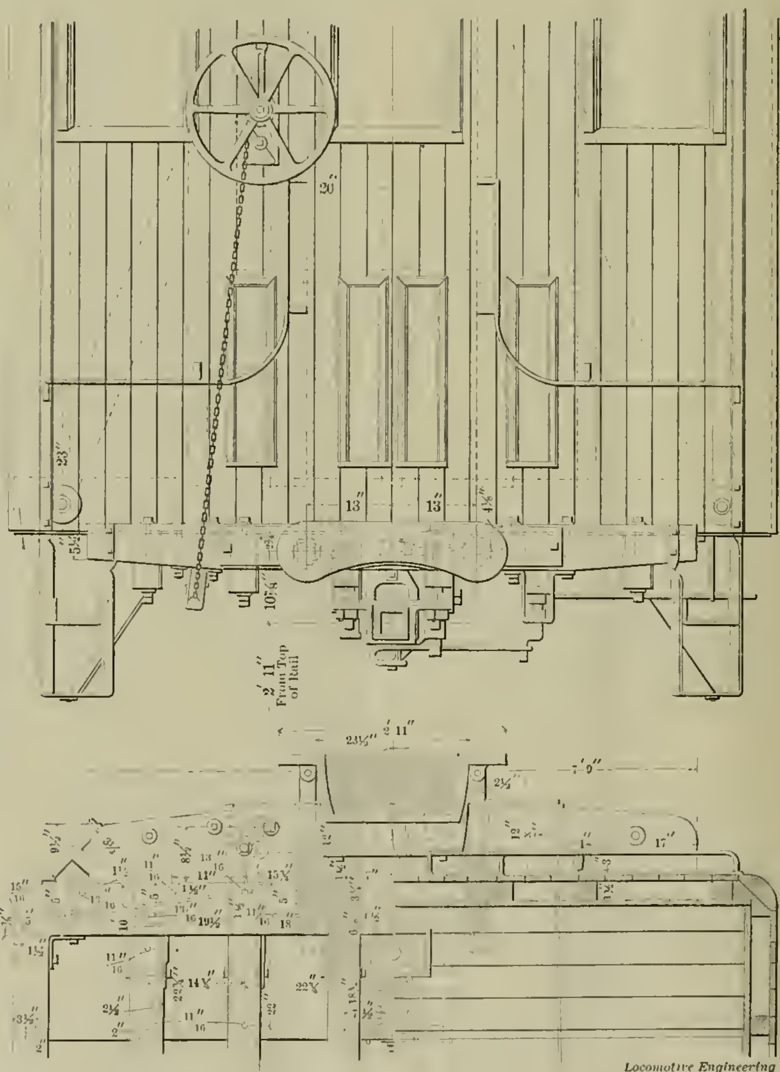
These cars are 55 feet long, 9 feet wide inside, and 6 feet 10¼ inches high from floor to top of plate, dimensions that give ample room in the clear. The two side door openings, at the center, are 6 feet 1¼ inches high and 6 feet 11 inches wide in the clear, and constitute the only doors in the car. These are shown, together with the framing, in Fig. 1, together with the casings for the solid and open grated doors. No pains have been spared in the matter of ventilation, as may be seen by a reference to the details of the ventilators for the sides and ends; the ventilators are of the sloping slat order made substantially of cast iron, and covered on the outside with wire netting, as well as backed on the inside of the car by a solid



ERIE HORSE EXPRESS CAR.

cover which is made to lift and secure up, where necessary to do so. The ventilators in the clear story are also of the slatted type and made to swing in with hinges at the top. The windows are barred and fitted with drop sash, all in keeping with the idea of safety and comfort for the animals while in transit.

The cars are divided into three nearly equal sections transversely, by means of gates swinging from either side and joining at the center. These gates are solidly built of 1¼-inch hardwood and reinforced with light wrought-iron straps. They are shown in position in Fig. 3, as is also a detail of one gate in plan, showing hinge construction and how secured to side of the car. The side door hanging is seen to be that of the roller style used in baggage and express cars. In Fig. 2 the end arrangement is shown in elevation and plan, showing the hand railing and steps and what there is of the abbreviated platform, which extends only 12 inches from the end sill at the widest part. We are indebted to the courtesy of Superintendent of Motive Power Mitchell for the drawings of this handsome horse express car.



ERIE HORSE EXPRESS CAR.

100,000-Pound Steel Cars.

The order recently placed by the Pennsylvania Railroad Company for 1,000 steel cars evinces a confidence in the coming car that will have a great influence in the adoption of them by other roads. The Schoen Pressed Steel Company have the contract for these cars, which are to be of 100,000 pounds capacity, and have a light weight of 37,000 pounds. The axles will be of open hearth steel, and have journals 5½ x 10 inches. The ratio of nearly three pounds of paying load to one of dead weight, will strike those interested as verging closely on figures that mean economy in transportation. These cars are booked for service this summer. This is the largest order thus far placed for steel cars.

Improvements in Naval Machinery.

One of the most efficient war ships owned by the United States during the civil war was the New Ironsides, an ironclad built by the Cramps in 1862. The latest battle-ship built by the same firm was the Iowa, launched last year. Each of these ships represents the maximum development of its day. The New Ironsides had one machine—her main engine, involving two steam cylinders. The Iowa has seventy-one machines, involving 137 steam cylinders.

The guns of the New Ironsides were worked, her ammunition hoisted, the ship steered, the engine started or reversed—in fact, all functions of fighting and manœuvring—by hand. The ship was lighted by oil lamps, and ventilated, when at all, by natural air currents. Although the most advanced type of her day, she differed from her greater battle-ship predecessor, the old three-decker Pennsylvania, only in four inches of iron inside armor, and auxiliary steam propulsion. She carried fewer guns, on fewer decks, than the Pennsylvania, but her battery was, nevertheless, of much greater ballistic power.

In the Iowa it may almost be said that nothing has to be done by hand. Her guns are loaded, trained and fired, her ammunition hoisted, her turrets turned, her torpedoes ejected, the ship steered, her boats hoisted out and in and the interior lighted and ventilated, the great searchlights operated and orders transmitted from the bridge or conning tower to all parts of the ship by mechanical appliances. The maximum shell range of the heaviest guns of the New Ironsides was about a mile and a quarter; that of the heaviest guns of the Iowa is about eight miles.

We have mentioned before, and may have to again, the lack of coat and hat hooks in passenger cars. We mean the day coaches, which most of us travel in when we can't cough up the extra fare—and the inevitable tip—of the parlor car. If anyone is fortunate enough to have a new overcoat, it gets jammed full of creases over a seat; bangs somebody in the back if it's over the seat ahead, or crawls down your own neck if you try to lean back against it. The hook needn't be solid silver or even brass—a plain wire or cast-iron hook between the windows is all we ask. The extra cost of these can be taken from some of the overhead decoration, and all will appreciate it. Give us coat hooks—or summer the year round.

WHAT YOU WANT TO KNOW.

Questions and Answers.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(33) B. McC., Louisville, Ky., asks how many drops of valve oil there are to a pint. A.—In a table furnished by a prominent lubricator manufacturer, the capacity of an ordinary triple-feed three-pint lubricator is given at 19,800 drops, for Galena oil. There are, then, 6,600 drops to the pint.

(34) J. H., Phillipsburg, N. J., asks:

Can you tell me the cause of a double-tube Metropolitan injector losing water at overflow while working? A.—It is probably due to overflow valve leaking. In this type of injector the overflow valve is subject to boiler pressure when working, and this causes leakage while working if the valve is worn. With open overflow injectors it would be due to entirely different causes.

(35) R. F., New Orleans, La., asks:

How many tons of coal would a coal pit of the following dimensions hold: Length, 9 feet; width, 4 feet, and depth, 3 feet 3 inches? A.—Assuming your coal to weigh 57 pounds per cubic foot (average weight of bituminous coal), one ton will require a space of 35 cubic feet, and $9 \times 4 \times 3.25 \div 35 = 3.34$ tons = capacity of coal pit.

(36) W. B., Wynne, Ark., asks:

Will a blow in cylinder packing cause water to foam in a boiler? A.—No. The blow in cylinder packing is harmless as far as its action on the boiler is concerned, except in waste of steam. Steam when blowing through packing, passes out to the exhaust, first at the opposite end of cylinder from that which received it, until exhaust closure takes place, when compression forces the blow back to the side from which it originally came, and thence out to the exhaust.

(37) C. A. E., Carlisle, Ind., writes:

When the reverse lever is placed in the center of the sector, will the valves cover all the ports on each of the engines? A.—When the link is in its middle position and the crank is on the center, the valve on that side is open to the amount of the mid-gear lead, which may be from ¼ to ½ inch; while the valve on the opposite side will be practically over the center of its seat, and therefore lapping both steam ports—or in other words, the valve will be open when the crank is on the centers, and closed when on the quarters, for the central position of the reverse lever.

(38) L. W. K., Truro, N. S., Canada, asks:

How many pounds per hundred does steam decrease from boiler to high and low-pressure cylinders of Vauclain compound engines with full throttle? A.—On some cards taken by ourselves from a Vauclain compound working at maximum point of cut-off (about 21 inches), with a boiler pressure of 170 pounds and full throttle, the initial pressure on high-pressure piston was 165 pounds, and on low-pressure piston 82 pounds. The decrease therefore was about 3 per cent. for the high-pressure cylinder, and 52 per cent. for the low-pressure.

(39) A. M. H., St. Louis, Mo., asks why some locomotives—the Erie rebuilt engines, for example—have their cabs one-half or two-thirds over the boiler and drivers, and also whether the engineer and fireman are in the same cab, or whether the latter is at the boiler-head end. A.—Cabs are located forward on account of the wide fireboxes of the Wootten type, which makes it impossible to place them back in the position usually occupied with the narrow or ordinary firebox. The fireman's exercises with the scoop causes his stay at the boiler head to be a protracted one as a usual thing, but he may occupy his side of the cab when his duties permit.

(40) J. M. D., Pembina, Wis., writes:

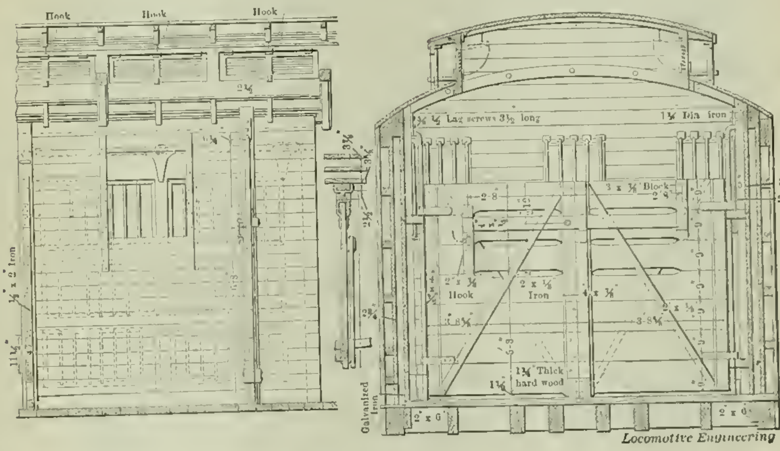
I have a Nathan sight-feed lubricator, and it has worked good until lately. At present it is almost impossible to make it drop at a regular feed. It will run a steady stream sometimes for a week, and then will drop all right for a time. I have blown it out thoroughly without any beneficial results. Could you give any cause for this behavior, and how to remedy it? A.—Choke plugs that are too loose in the fit, or that have feed holes too large, will cause an intermittent feed; the hole should not be more than 1-32 inch in diameter. Another cause for irregular action is obstructed equalizing tubes; if these tubes are kept free and the choke plugs tight, and with proper sized holes, the lubricator will be in the condition intended for correct work by the manufacturer.

(41) J. W. K., Basalt, Col., asks:

1. When an engine is running ahead and pulling a train, where is the most strain, on the front or back pedestal jaw, or is it equal? A.—2. The strains on the front and back of the jaw are equal, exerted on the front when the crank is above the axle, and on the rear when the crank is below the axle. 2. How much of the power developed in the cylinders of a locomotive is required to move the engine itself? A.—2. The power required to overcome the internal resistances of a locomotive is a variable quantity depending on the conditions and type of engine, and also steam pressure. There is a great diversity of opinion on the subject, and no exact data that we are aware of. It has been our practice to assume, in the absence of accurate knowledge for a particular case, that about 10 per cent. of the power of an engine in average condition was consumed in overcoming the friction of its parts.

(42) Critic, London, Ont., asks:

What difference in the consumption of fuel would there be in passenger trains of the same class and weight running 100 miles, one leaving on time and arriving on time, and the other leaving twenty minutes late and arriving on time? A.—No intelligible answer can be given to this question unless we knew the weight of the train and the relative speeds made. 2. Is there any standard theory of firing soft coal? A.—2. No. Every kind of coal has to be fired in the way that will generate the most steam. How to do this must be left to the intelligence of the fireman. 3. What is the general cause of a poor steaming engine, the boiler being tight in every particular and fuel good? A.—3. Bad steaming might arise from several causes: First, from want of the draft appliances being properly arranged, and second, from the boiler being too small to supply the steam used up by the cylinders. 4. What is the smallest consumption of oil on record per 100 miles for standard



ERIE HORSE EXPRESS CAR.

passenger engine? A.—4. We cannot tell. 5. How often should a fire be poked or the shaker bar used in a run of 200 miles with a passenger engine making an average of fifty miles an hour and burning about 6 tons of coal during the run? A.—5. That would depend very much on the quality of coal. As a general thing, it is a good plan to stir up the fire as little as possible.

(43) A. H. M., Walnut Creek, Cal., asks:

1. What degree of efficiency is attained in use of a compressed air jet in blowing a forge fire, as described some time since in LOCOMOTIVE ENGINEERING—that is, how much more power would it take to compress the air required than to furnish the same blast from a bellows? 2. What will be the volume of air at atmospheric pressure which will be used under the conditions in the article referred to, namely, 1-32-inch jet at 60 pounds pressure, and will the pressure in tuyere be as great as with an ordinary fan blower? A.—These questions cannot be answered satisfactorily by means of calculations, and when that method of solution is barred, resort must be had to experiment for their determination. This, by the way, is how such information as is asked for above is usually obtained. We do not know of any data showing the relative power required between steam compression and hand blast by bellows. Neither is there any information as to volume of air used by induced current through a conical opening as in the case noted. It was found, however, in the above instance that the 1-32-inch opening was too great when the valve was full open, at 60 pounds pressure, and the pressure had to be reduced by wire drawing at the valve, being in all cases greater than with the fan blower previously used.

One of the most interesting and attractive magazines that comes to our office is the *Pall Mall Magazine* of London. This magazine is only a few years old, but it has proved itself a most stalwart young candidate for public favor, and has jumped vigorously into the good graces of American readers. There is no finer illustrated magazine in the world. Its scope mixes fiction, history and current topics in wonderful harmony. It is difficult to find a reader of magazine literature who will not secure congenial reading in this publication. The *Pall Mall* devotes more attention to American themes than any other foreign magazine, and we find that it now has a New York office and runs American advertisements exclusively in the American edition. An announcement is made that the June and July numbers of this magazine will contain articles by Angus Sinclair on "Comfort in Railway Travel." The articles are profusely illustrated with magnificent half-tone cuts.

Electric Currents and Circuits.

As there have been numerous requests for "more electricity," the writer will endeavor to give a little elementary talk on currents and circuits, so as to familiarize the readers with some of the details of electrical machines before any more is written about them. We spoke of the "lines of force" flowing out from the north end of a magnet and back into the south end. This is a supposition which seems to be borne out by facts, as can be seen in Fig. 1, the four small compasses indicating a magnetic influence as shown, and

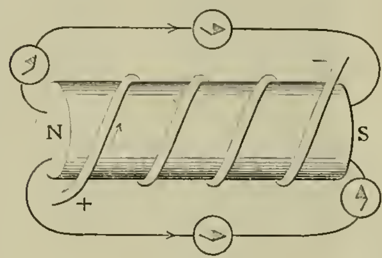


Fig. 1

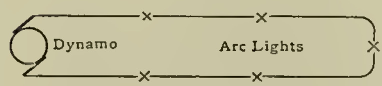


Fig. 2

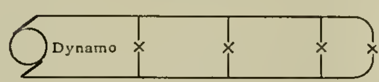


Fig. 3

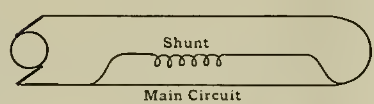


Fig. 5

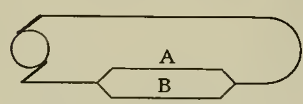


Fig. 4

ELECTRIC CIRCUITS.

will vary their positions as they are moved along the bar.

The wire on the bar of iron is supposed to be carrying a current of electricity which enters at the positive end, marked plus (+), and flows out of the negative or minus end marked —. These are the customary markings for flow of current, and whether it really flows or not, this offers a very reasonable theory, which seems to be borne out by facts.

Current flowing as indicated will make a north pole of N and a south pole of S, which can be remembered by this little rule:

Looking at the end of a coil of wire, if the current moves in the opposite direction from the hands of a watch, the end nearest you will be a north pole.

Of course if it moves the same as the hands of a watch, it will be a south pole. This is an invariable rule, and shows how easily we can change the polarity of a magnet, by simply reversing the connections and sending the current through in the opposite way.

If you wish to find which way the current is flowing in a wire, take your compass and place either above or below the wire, with the needle parallel to wire, remembering that:

If the current flows from the North pole, Over the needle to the South, the needle will be deflected to the East.

The initials NOSE may help to remember this.

Also that:

If the current flows from South to North Over the needle, the needle will be deflected West.

In this case the initial letters are SNOW.

These are based on the fact that a magnetic needle always tends to set itself at right angles to a passing electric current, and give another instance of electricity acting through space without any mechanical connections.

After getting the idea of electricity flowing through a wire, just as water or steam flows through a pipe, it is easy to see how we must have a complete circuit or line of pipe if the flow is to be uninterrupted. The dynamo (or battery) can be likened to a pump which is continually pumping the same water over and over again. In this case the piping must be complete, although the water can go through motors or other devices before it returns to the pump.

In Fig. 2 the dynamo is furnishing currents for five arc lights, although for that matter they could be incandescents or motors, if made to run on a "series" circuit as shown; a "series" circuit being simply a continuous circuit with the lights or motors so placed that the current must flow through one before getting to the next—hence the name "series." This is used mostly for arc lamps out of doors.

Fig. 3 shows another kind of circuit, which is called a "multiple" or "parallel" circuit. This has two wires, which have no connection except when the lights or motors are switched on, and no current is generated by the dynamos unless there is a complete circuit for its flow. The dynamo armature simply revolves, doing no work until the circuit is completed by the switching in of lamps, motors or other devices.

This system is generally used for incandescent lamps and motors, also for street railways.

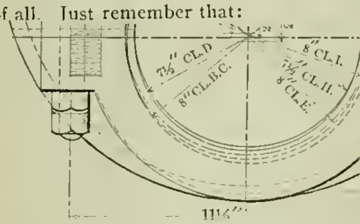
There are modifications and combinations of these circuits, but they are not used in railway work, and will not be considered.

If we make two branches of the same size pipe, the water will divide and flow through each pipe in equal quantities, and if we divert an electrical circuit in the same way, current flows equally in each branch. This is called a divided circuit, and is shown in Fig. 4, *A* and *B* each taking half the current.

If we make one of these divisions of much smaller wire than the other, or use much more wire in it, or both, most of the current will flow in the large main wire, and only a small portion through the small wire. This small wire is called a "shunt," and the "shunt circuit" is made use of to obtain a small current from the wires of the main circuit. This is done in many dynamos and motors to obtain current for magnetizing the fields, only a small portion of the main current being needed. This is shown in Fig. 5.

In all shunt or divided circuits the current flows in accordance with the resistance. If one branch of the circuit has twice the resistance of the other branch, it will only get one-half as much current as the other, or one-third of the whole. Knowing this, it is easy to get any proportion you wish, and on many dynamos or motors the fields only get from 5 to 7 per cent. of the entire current; some more, some less.

Many get twisted when it comes to electrical terms, such as volts, amperes, etc.; but as they are the units of electrical practice, they should be mastered first of all. Just remember that:



EVOLVING

Engine Classes.		Bearing Face.	Total Width.	Diam.
A—F		1⅞	2⅝	14⅛
B, C	B 3 engs., C 6 ", E 3 "	2¼	3	15¼
E	B 3 ", E 2 "	1⅞	3	15
D		1⅞	3	15
H		2	3	15
I		2¼	3	15⅜

tinued. On his way to the office, the following morning, he stopped at the Union station and noted what some of the other roads were using. When again at his desk, he felt that what he did not know about the subject in hand was really of no great importance.

Here is a copy of a table that the Draftsman made up from his memoranda:

REARRANGED BY SHAFT SIZES.

Class	Shaft.	Width.	Diam.	Throw.
A—F...	7	2⅝	14¾	5½
D.....	7½	3	15¾	5½
H.....	7½	3	15½	5¼
B, C, E	8	3	16 / 15¾	5½
I.......	8	3	16	5¼

not a power, but simply a means of transmitting power from one point to another.

We see the motor car humming along, and are very apt to think of the electric motors as the power used. We forget the wires running back to the station, where the steam engine or water wheel is driving the dynamo, so that it can produce current with which to drive the car. The motors move the cars, but the engine is the power just as much as though it ran belt or rope to each one. Electricity is better, handier and cheaper in many cases, but it is only the "belt," not the power.

CANADIAN PACIFIC COMPARTMENT SLEEPER.

Canadian Pacific Parlor Car.

The half-tone of the Canadian Pacific parlor car "Yamaska" represents one of the magnificent cars running in their transcontinental trains. The cars have, in addition to the usual handsome appointments of their class, one feature that is now gradually working its way to the front on the most progressive roads, and that is a system of partitions, or bulkheads, across the car, dividing it practically into a number of compartments, yet leaving a clear passageway from end to end. This construction is proving a card wherever used, since it furnishes a degree of privacy that is enjoyable to parties travelling together. We are indebted to Master Car Builder Apps for the photograph from which the picture is made.

The Railway Age says: "General Superintendent G. R. Brown, of the Fall Brook Railway Co., at Corning, N. Y., of the 'Brown system of discipline,' comes of a hardy stock. His parents recently celebrated, at their farm home near Elmira, N. Y., the sixty-third anniversary of their wedding. In an interview on that occasion Mr. Brown said: 'With the exception of four winters, when I taught a district school, I have been a railroad man all my life. I had my first experience when I was a boy. You see that stretch of the Northern Central Railway track down past that old barn on father's farm? It was along there, in the year 1856, that I was a water boy to a gang of Irish laborers who were then building the Northern Central road. I hired out at 50 cents a day to a contractor and labored faithfully in the hot sun for fifteen days at the beck and call of the trackmen. When I went after my hard-earned pay, the boss with whom I bargained had skipped that section of country, and he still owes me just $7.50, with interest from date.'"

The Draftsman—Evolution of a Standard.

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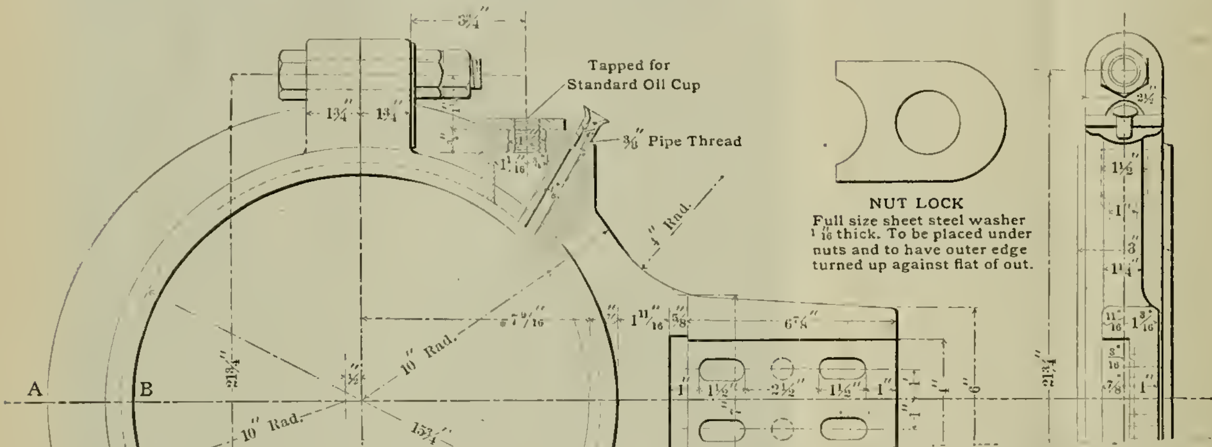
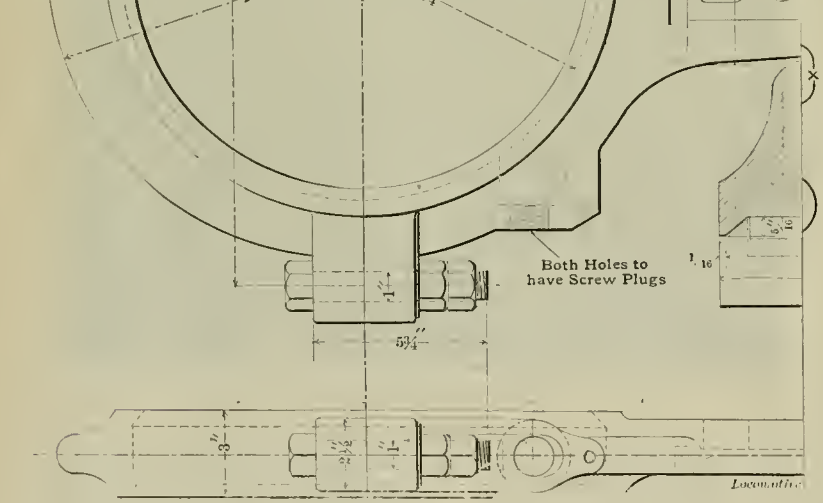
The letters were put away for future reference, and all of the eccentric and strap drawings brought out for examination, and the Draftsman made some memoranda. He noted that the bearings of some classes were made with the sides of the tongue bevelled off instead of square, while all the other ones had square corners on the tongue.

"I like that bevel," mused the Draftsman; "it is an approach towards a spherical bearing which would be ideal for a locomotive eccentric. That axle is constantly on the 'go' up and down, relatively with the frame, and as the engine rolls there is a twist to the motion which tends to bind the straps sidewise and wears the flanges thin. I don't believe that a broad, straight eccentric bearing is the thing." He noted that the bolts securing the ec-

EVOLVING ECCENTRICS.

or line of pipe if the flow is to be uninterrupted. The dynamo (or battery) can be likened to a pump which is continually pumping the same water over and over again. In this case the piping must be complete, although the water can go through motors or other devices before it returns to the pump.

In Fig. 2 the dynamo is furnishing currents for five arc lights, although for that matter they could be incandescents or motors, if made to run on a "series" circuit as shown; a "series" circuit being simply a continuous circuit with the lights or motors so placed that the current must flow through one before getting to the next—hence the name "series." This is used mostly for arc lamps out of doors.

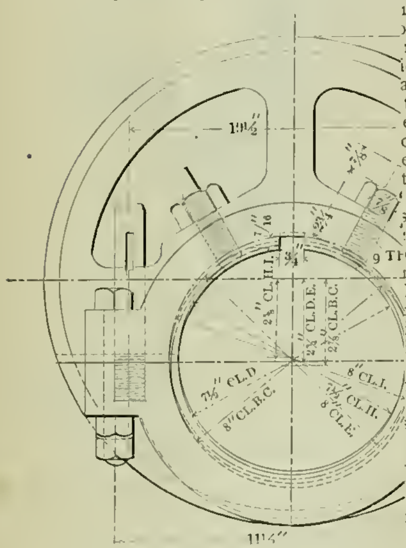
Fig. 3 shows another kind of circuit, which is called a "multiple" or "parallel" circuit. This has two wires, which have no connection except when the lights or motors are switched on, and no current is generated by the dynamos unless there is a complete circuit for its flow. The dynamo armature simply revolves, doing no work until the circuit is completed by the switching in of lamps, motors or other devices.

This system is generally used for incandescent lamps and motors, also for street railways.

There are modifications and combinations of these circuits, but they are not used in railway work, and will not be considered.

If we make two branches of the same size pipe, the water will divide and flow through each pipe in equal quantities, and if we divert an electrical circuit in the and it gets the blame; whereas a loose bolt on the other side was the weak link. Now the proper thing to do is to secure the bolts and nuts so that they will not get loose," and he did as the drawing will show.

The erecting drawings of these engines were next examined, some more memoranda taken, and then the Draftsman spent the rest of the day looking over engines in the shop and roundhouse, and quizzing the foremen, so as to get information from both the shop and road points of view. He found several of the old-style bevel bearing eccentrics in very good condition after several years of service, and wondered why that style had been discon-



EVOLVING

Engine Classes.		Bearing Face.	Total Width.	Diar
A—F		1⅞	2⅝	14⅛
B	B 3 engs.			
	C 6 "	2¼	3	15¼
C	E 3 "			
	B 3 "			
E	E 2 "	1⅞	3	15
D		1⅞	3	15
H		2	3	15
I		2¼	3	15⅜

tinued. On his way to the office, the following morning, he stopped at the Union station and noted what some of the other roads were using. When again at his desk, he felt that what he did not know about the subject in hand was really of no great importance.

Here is a copy of a table that the Draftsman made up from his memoranda:

Rearranged by Shaft Sizes.

Class	Shaft.	Width.	Diam.	Throw.
A—F...	7	2⅝	14¾	5½
D......	7½	3	15¾	5½
H......	7½	3	15½	5¼
B / C / E	8	3	16 / 15¾	5½
I......	8	3	16	5¼

proved to be the best shape for their particular instrument.

The writer has no desire to enter into a discussion on this subject, and has merely given what seems to him a fair explanation of its working. Whether this is correct or not does not affect the other portions of the articles, as the manner of working described is as it actually exists, regardless of which theory is considered most plausible by the reader.

The Bignall & Keeler Manufacturing Company, of Edwardsville, Ill, have issued a new catalog, No. 14, showing their Peerless and Duplex pipe-threading and cutting machines. In addition to these there are smaller tools for similar work, and much interesting data on mechanical subjects, including tables from Kent's "Pocket-Book." It is well worth keeping for reference.

The Boston Belting Company have issued a circular concerning Forsyth's Patent Gutta-balata. There are a great many good points to this form of belting, which is comparatively new to this country, although it has been in use in European countries for years. It is seamless, and therefore has no external seams to open or come apart. It can be run with either side next to the pulley, and has its plies so firmly united that separation is almost impossible. This belting seems to be thoroughly worthy of a trial.

On April 9th Mr. George J. Gould had a lively ride over the Wabash. He and his party, occupying two cars, were returning to New York from Omaha. Engineer Dissler and Fireman Bell, with engine No. 177, brought the train from Tilton, Ill., to Indianapolis—103 miles—in 1 hour and 50 minutes. Between Delphi and Logansport the speed indicator registered 77 miles an hour. Engineer Sutcliff and Fireman Wagner, with engine No. 167, took the train from Peru to Montpelier—100 miles—in 1 hour and 59 minutes.

It is not generally known that at one time postal authorities had the right to transport persons as well as what is now understood to be postal matters. An act was passed in the English Parliament of the establishment of a postal department in the American colonies in the ninth year of Queen Anne, which made it the duty of American post-masters to provide horses and guides for travelers, and each traveler was allowed to carry merchandise up to 80 pounds in weight on the guide's horse free. For 150 years the post-office packet service of England was the only regular vehicle for over-sea travel, and its service was only turned over to private hands in 1830.

President Thomson on Army Transportation.

President Frank Thomson, of the Pennsylvania Railroad Company, said yesterday that the statements published in several newspapers that he had been made an Assistant Secretary of War in charge of military transportation had no foundation in fact. The government officials were, however, cognizant of the fact that they could call upon him at any time for any service he could render. He said there was nothing in the railroad situation which in any way corresponded to the conditions existing during the civil war or that would require the government to assume any direct control over the railroads of the country. Then the railroads were of prime necessity in conducting military operations. Large bodies of troops and immense amounts of supplies had to be expeditiously moved, and it was essential that the government should have supreme control of any road which it might wish to use.

A military railroad organization was absolutely necessary, however, to operate the lines in such portions of the Confederate States as were held by Union troops. The captured roads had to be put in order, the burned bridges rebuilt, and, in most cases, new rolling stock supplied; and the exigencies of such a service demanded an organization entirely unique in the history of railroads. The war with Spain would not probably interfere with the running of a single train.

Those who are familiar with Mr. Thomson's early railroad experience will remember that Col. Thomas A. Scott, who had been put in charge of the military roads by President Lincoln at the breaking out of the war, sent at once for Mr. Thomson, then about attaining his majority, to leave Altoona, where he was engaged in emergency duties, and assist him in reorganizing the roads south of the Potomac. In the three years that followed, during which his field of operations extended through Virginia, Kentucky and Tennessee, including the roads south of Nashville, the increasing responsibility of his position and the unexpected problems presented served to strengthen the facility of resource of the young railroad manager, and he left the service with an enviable record and an invaluable fund of experience.

One of the most brilliant transportation movements of the war was carried out by Mr. Thomson after he had returned to service on the Pennsylvania Railroad and had been in his new position only a month. Col. Scott telegraphed for him to come back to Washington, and he was specially detailed by the Secretary of War to take charge of the transportation of two entire army corps, the Eleventh and Twelfth, with their equipment of artillery, horses, wagons, camp equipage, hospital supplies and baggage, from the Army of the Potomac, near Washington, to the

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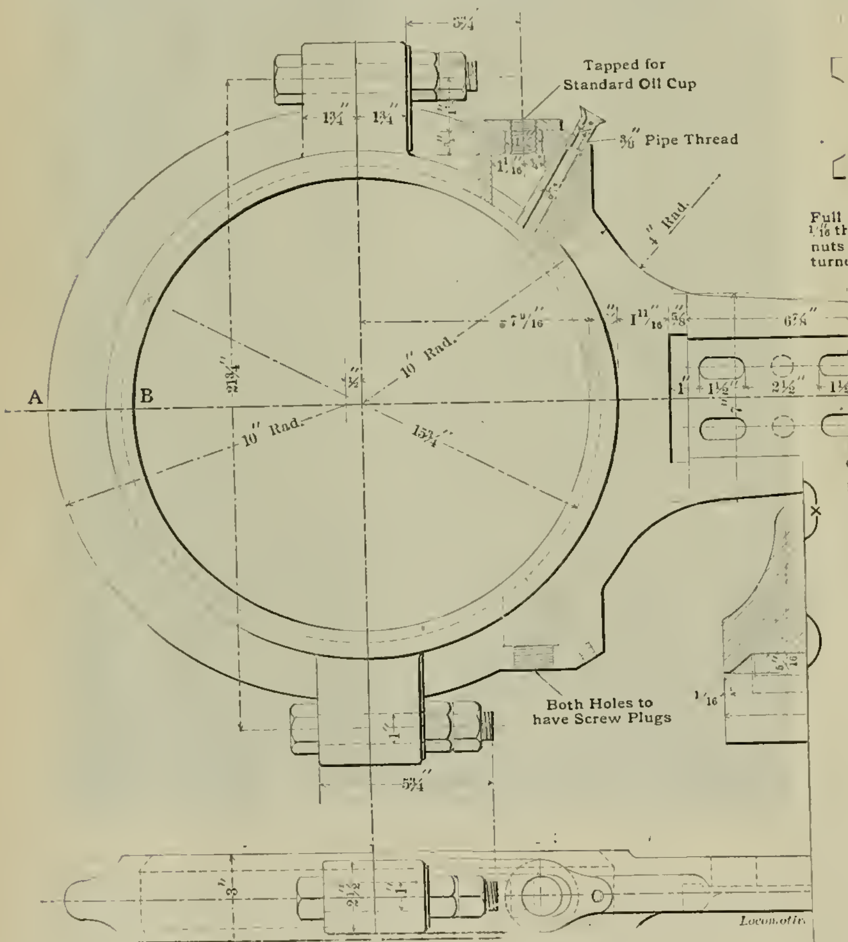

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Army of the Cumberland, at Chattanooga. It was a movement absolutely necessary for the preservation of the latter army, and it was a herculean task, but it was fully accomplished in fourteen days. It was regarded then as little short of miraculous, in view of the conditions and the facilities, and would be a remarkable movement even now.

The present war is not likely to offer any opportunities to young men for such experience in emergency railroad service; but there are plenty of unsolved problems for Uncle Sam's boys in the United States navy which some unfledged genius may work out.—*Philadelphia Ledger.*

The Sargent Company, Chicago, have displayed seasonable enterprise in getting out a map showing the West India Islands as a group, the Island of Cuba in particular, and the world, showing relative positions of various countries. Send for it and you will be very much pleased with what you receive.

"Ocean to Ocean" is the title of a neat pamphlet issued by the Galena Oil Company, of Franklin, Pa., for the purpose of letting the world know that their oil is used on 94 per cent. of the railroad mileage of the United States, aggregating 168,000 miles, 35,000 locomotives and 1,300,000 cars.

The coaches of the New England Railroad are lighted with oil lamps arranged in the best possible manner to get their rays down to the seats. There are seven of these lamps on each side of the car, and the way they are put up is what appeals to the traveler. They are secured to the clear story sills by brackets, which brings the lamps lower down over the seats and gives a better light than by the conventional but inconvenient location in the center of the clear story. Where oil lamps are used, we don't know of any better arrangement of them than the above; they give up their illumination to better purpose than when farther away.

Several towns in Connecticut have claimed each that the first person in this country to receive a patent had lived in that town. It is doubtful if any one can claim an older date than the following: Otis A. Smith, manufacturer of firearms at Rockfall, is in direct line of descent from Joseph Jincks, of Lynn, Mass., the first recorded inventor in America. In 1655 he was granted a patent for an improved scythe. He also made the first castings in this country, and in 1652 made the dies for the famous "Pine Tree" shillings. In 1654 Mr. Jincks made for the city of Boston the first fire engine in America, and his name is also associated with other inventions of that time.

Engineers' Convention.

The biennial convention of the Brotherhood of Locomotive Engineers will be held in St. Louis beginning May 11th. All the officers have to be re-elected or others chosen, except that of the chief engineer, who holds over for two years longer. There is some talk of contests for the different positions, as there always is when the terms of office expire, but we expect that harmony will eventually prevail by the re-election of the men who have performed their duties satisfactorily.

The most important question to come before this convention is a proposal to federate with other railroad labor organizations. The firemen, conductors, trainmen and telegraphers are willing, like Barkis, to confederate, and efforts will be made to convert the delegates to bring the Brotherhood of Locomotive Engineers into line. Similar attempts have formerly been made without success. It is a momentous question demanding very serious consideration.

The Maine Central.

Away up in Maine there is a line of railway comprising a length of 821 miles that furnishes a theme for reflection to the railroad man or the observer of any other calling, but especially the man who has railroaded at some period of his existence, because he will be, more than any other, better qualified to appreciate and understand the many little things going to make up successful administration of railroad affairs. The temper of the rank and file of a road is a pretty good index of the character of the treatment received from the executive officers.

This was so apparent on the Maine Central during a recent trip over that road that a mental note was made to the effect that things were going satisfactorily to everybody in that corporation. The secret of the manifest good feeling came out in a conversation with General Superintendent McDonald, who, in the course of his remarks, dwelt eloquently on their Brown system of discipline and the effect it had shown on all subject to its provisions. We incline to the belief, though, that, while the system is the best, the results of its working are greatly enhanced by its administration at the hands of officials who can be fair without a system, and that is what the officers of this road are, if they are judged by the results of both combinations.

The passenger equipment of the line is one that must be, and is, the best, for the reason that tourist travel is immense during the summer months, people simply swarming to the beautiful river, lake and ocean resorts that are reached by the road, either by its rail or steamer lines. An idea of the volume of this travel may be had when it is known that more than 17,500 people were represented by the Pullman car receipts alone during the season of 1897. These figures are away inside of the actual travel, since they do not include coach patronage or private cars; they are given simply to show that the Maine Central is in the railroad business.

The time is good and sharp—forty-five miles an hour on the card—and on account of a fairly level road this is easily made by Mr. Pillbury's standard eight-wheel engines, which are elegant specimens of the kind. No extra heavy power is needed on the line, except on the mountain division, where some hills 116 feet to the mile are encountered in reaching Crawford's Notch, in the White Mountains. Consolidations are used there. There is much on this road to attract the traveller in the way of scenery and in the way to reach it.

Motive Powers, Past, Present and Future.

The above was the title of the subject for discussion at the April meeting of the New York Railroad Club before an attendance that filled the rooms to overflowing. Mr. S. M. Vauclain, Superintendent of the Baldwin Locomotive Works, opened the discussion, taking for his theme motor cars, tracing them from the first needs that brought them into use up to those of to-day, and referred to the various methods of propulsion from steam and soda to compressed air and electricity. The latter form of motor drove for a time the others out of the field, but changed conditions now make it necessary to have a steam motor that has a capacity for both passengers and freight. Such cars have recently been built and were giving satisfactory service, and these were shown to the club by the stereopticon during the remarks of the speaker. Some details of a motor car now under way at the Baldwin Locomotive Works for the Cincinnati, Hamilton & Dayton Railroad were very interesting, notably that of the boiler, which was of the magazine type and fed the coal automatically to the grate by gravity, so that one filling would last for a run of forty miles, and the arrangement of the link motion up in the cab under the eye of the engineer, by which the line of motion of the links was at right angles to the axis of the cylinders.

Mr. Merrill, Second Vice-President of the Erie, followed with some of the causes which made the steam motor a necessity to railroads at this time, and gave some figures showing the cost of operation of his motor as compared with that of an ordinary passenger train, being 16 cents per mile, which covered all expenses of operation in the first case, against 27 cents for the latter. The motor showed a saving of about $240 per year.

Mr. Vreeland, President of the Metropolitan Traction Company, gave some interesting information about how the cable system came to be installed in New York, and also gave a history of the underground trolley system on his lines; but, after all the improvement in surface transportation, he was forced to admit that the horse was still to be seen hauling cars in the streets of New York.

Mr. Potter, of General Electric Company, talked on the subject of the overhead trolley and the third rail, and presented the power question interestingly from his point of view, but conceding that there was a place for the steam motor car.

Mr. J. W. Duntley, President of the Chicago Pneumatic Tool Company, has lately been on a visit to Europe, and he wrote us from Berlin, Germany, telling that he had received a most enthusiastic welcome everywhere that he went to introduce his tools. During the months of January and February their London office received orders for 100 hammers, 60 drills, 10 riveters, 5 flue rollers and 20 breast drills. Mr. Duntley has received stock orders for over 200 machines, to be distributed each month. European machine men admit that no new business has ever jumped so rapidly into popularity as that of the tools supplied by the Chicago Pneumatic Tool Company. The pressure of business is so great that the company have decided that they must either build a manufacturing plant in Europe or double the capacity of that in St. Louis.

The Lunkenheimer Company, Cincinnati, have issued their catalog for 1898. It contains illustrations and descriptions of the principal articles made by the company. These appear to comprise every kind of steam fitting in use. The catalog will prove a useful reference for persons having to do with steam fittings. It will be sent on application.

William G. Creamer died in Brooklyn last month, aged seventy-two years. Mr. Creamer's name is associated in the minds of many railroad men on account of the emergency brake which he invented and has applied to many roads. It was a spring brake, which had to be wound up to be ready for use. Connection was made with the bell cord, which enabled the engineer to apply the brakes when necessary.

The Standard Tool Company, Cleveland, O., are sending out a little pocket-book containing a great deal of valuable information for shop men. It contains useful information about milling cutters, twist drills, wire gages, speed of drills and other matters that shop men are interested in finding an easy reference for. We understand the book is given away free.

The Buffalo Forge Company are meeting with a great deal of success with their down-draft forges for blacksmith shops. They say that this style of forge is effecting a revolution in blacksmith-shop equipment. They have recently received a lot of orders for this kind of forge from Germany. The engine department of this company is pushed with orders at present, and they are building several engines for the United States Navy.

Mr. O. Stewart, superintendent of motive power of the Bangor & Aroostook Railroad, is taking the slip out of a giddy old eight-wheel engine, by putting 4½-inch tires on the 56-inch wheel centers. He don't have to resort to that scheme on his new heavy standard engines; they are ranked among the best passenger power in the country.

Engineer E. L. Dunkle, of engine No. 1391 of the Pittsburg division of the Baltimore & Ohio, knows something about Indian fighting. While going up the Allegheny Valley Railroad he got mixed up in an altercation that arose between some noble Cornplanter Indians and the train crew, and one of the braves chewed three of Dunkle's fingers.

The Baldwin Locomotive Works have issued an illustrated catalog, which appears to be the third of the year, showing a few leading types of locomotives built during the month of March. The general dimensions of the leading engines are given, and they are illustrated by means of very good half-tone engravings.

The engineering department of the Pennsylvania Railroad at Altoona are working on the designs of a locomotive-testing plant on lines similar to the locomotive instalment at Purdue University. The intention is to mount the journal boxes on a ball and socket arrangement similar to line shafting, the shells of bearing to be enclosed and automatically oiled by chain. A great many novel features will be introduced in the construction of this plant.

The address in Pittsburg of Manning, Maxwell & Moore, the Ashcroft Manufacturing Company, the Consolidated Safety Valve Company, the Hayden & Derby Manufacturing Company, the Pond Machine Tool Company, the Shaw Electric Crane Company and Pedrick & Ayer Company, has been changed from Telephone Building to the Park Building, Fifth avenue and Smithfield street, Pittsburg, Pa.

Samuel Norigan, road foreman of engines on the Cleveland & Pittsburg at Alliance, O., is a candidate for Sheriff of that county, and his many railroad friends propose to help him as much as possible.

Several of the roads running from New York to Niagara Falls have made reduced rates for those attending the convention of the American Society of Mechanical Engineers. Among these are the Lehigh Valley, West Shore, and, we presume, the New York Central, the Erie and the Delaware, Lackawanna & Western will follow suit. The rates are very reasonable, indeed.

Our Russian friends are in ecstacies over their new passenger train intended for the Siberian Railway. This train is to make the run from St. Petersburg to Tomsk in six days, twice a month. It comprises in its appointments all the luxuries now grown old with us, such as vestibules, hot water heating, electric lighting, library, bath, etc.; but they go us one better with a piano in the dining car. A dispensary is also one of the new things in this train; we have, however, run those for years. The American traveler can always get "medicine" from our dispensaries in dining and buffet cars.

The Pullman and the Wagner Sleeping Car Companies have both been putting into service for several years past compartment sleeping cars that have two berths in one room and give much more privacy to the occupants than the ordinary section sleeper. But at the same time the compartments take up more room, and a car so arranged does not accommodate so many passengers as a section car. Owing to this, the sleeping car companies have given notice that passengers will be charged 40 per cent. more for the accommodation provided by compartment cars than for seats and beds in the old style of car.

Mr. Joseph Sibley, of the Galena Oil Works, Franklin, Pa., is reported to have proposed a novel means of coast defense. He says that if benzine were conducted through pipes under water and released, the fluid would rise to the surface and permeate the atmosphere to a hight of 20 feet. Let a hostile fleet once enter the area thus charged and it is doomed to destruction; for the vapor would penetrate to the fires on board the ships and terrific explosions would follow, blowing up the vessels in all directions.

One reader of "Practical Shop Talks" usually means several of his friends a little later. All agree it's the best 50 cents' worth of sensible reading they know of.

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PRACTICAL JOURNAL of
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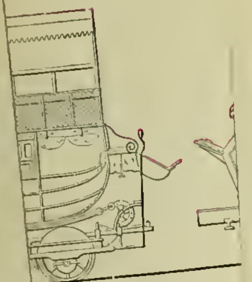

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Fig. 1. THIRTY-THIRD STREET STATION, SIXTH AVENUE LINE.

on an elevated engine with running orders.

Imagine, to begin with, a continuous bridge for your road-bed, with the hight from the rails to the ground varying from 11 feet 8 inches to 57 feet. Then think of stopping every 40 seconds for a portion of the route, starting, hooking her up mark stop is also about correct, as, with the stations having railings, there is simply an opening for each car platform, and mighty little leeway either. But the boys get used to it, and handle the vacuum (not air) brakes in fine style. Stops vary from 3 seconds up, with an average of about 10 seconds. This would be quite a revela- of course makes a longer stop necessary to unload.

New York is particularly adapted for elevated roads, as, being long and narrow, they all start from the Battery (with a branch from City Hall), and then separate into the Second, Third, Sixth and Ninth Avenue lines. Brooklyn being of

LOCOMOTIVE ENGINEERING
A PRACTICAL JOURNAL of RAILWAY MOTIVE POWER AND ROLLING STOCK.

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Elevated Railroading in New York.

The engineer and other trainmen on ordinary "land" roads, and especially those having long runs between stops, would find much to interest as well as to annoy them if they were suddenly landed on an elevated engine with running orders.

Imagine, to begin with, a continuous bridge for your road-bed, with the hight from the rails to the ground varying from 11 feet 8 inches to 57 feet. Then think of stopping every 40 seconds for a portion of the route, starting, hooking her up (twice usually), dropping the lever down in the corner, shutting off and stopping to a chalk mark in the time named.

This isn't exaggerated a particle, having timed them on several trips and watching things generally. The chalk-mark stop is also about correct, as, with the stations having railings, there is simply an opening for each car platform, and mighty little leeway either. But the boys get used to it, and handle the vacuum (not air) brakes in fine style. Stops vary from 3 seconds up, with an average of about 10 seconds. This would be quite a revelation to some local roads we could mention. The engines are small but powerful, although they have lots of work to do, pulling five cars full of people at the rush hours; for the elevated cars are filled to overflowing at times, and this of course makes a longer stop necessary to unload.

Fig. 1. THIRTY-THIRD STREET STATION, SIXTH AVENUE LINE.

New York is particularly adapted for elevated roads, as, being long and narrow, they all start from the Battery (with a branch from City Hall), and then separate into the Second, Third, Sixth and Ninth Avenue lines. Brooklyn being of an entirely different shape, the roads have to cross each other at numerous points, the last comer raising his tracks to clear the first road.

Don't imagine that because the road is elevated there are no grades. It's all hills and hollows in many places, some of the grades being as heavy as 3½ per cent. on the Kings County Road of Brooklyn, and the Manhattan Road, in New York, has a 2-per-cent. grade that is 1,828 feet long. These are equivalent to grades of 184.8 and 105.6 feet to the mile, respectively.

As the lines reach the more thinly populated districts, the stations are placed farther apart, and it becomes a little more like railroading, as you don't "shut off before you get started," as is almost the case downtown. The stations are interesting, and present many different plans of stairways for reaching the road from the street. This depends on their location, and almost every means of getting from the sidewalk to the station above is resorted to.

Sometimes it is plain sailing, as at Thirty-third street, shown in Fig. 1; but in others the stairs are fearfully and wonderfully made, going zig-zag, crosswise, under the railroad, and about every other way imaginable.

Stations are sometimes placed in the center of the elevated structure, between the two tracks. This saves a ticket office and a few men, and is used to some extent on the uptown stations after the traffic thins out, as well as in some of the Brooklyn stations. The side stations are shown in Fig. 2, which gives a good view

Fig. 3. COLUMNS IN THE STREET.

Fig. 2. SIDE STATIONS AT FORTY-SECOND STREET.

of the track and station platforms, to say nothing of the signs on the adjoining buildings. The station platforms are flush with the car platforms, so that there is no climbing up and down car steps at stations, which accounts for the short stops required at stations.

Some idea of the appearance of the structure, both in the street and where it spans from side to side, is given by Figs. 3 and 4. Needless to say, it is thoroughly substantial, and if anyone imagines it a kind of a "play" railroad, he is very much mistaken, even if the engines are not consolidations or monsters.

The Manhattan road has 36 miles of roadbed, 192 stations on its various lines, runs 1,116 cars weighing on an average 15 tons empty, has 326 locomotives, and is laid with 90-pound rails; so that it can give points to many surface roads that imagine they are "something of a railroad."

During rush hours the trains have five cars, filled to the doors, and the headway between trains is counted in seconds, regular running time being less than a minute apart, night and morning.

Express trains are run on some lines by using a third track in the center after leaving the downtown stations and running around the regular local trains. As all traffic is downtown in the morning and uptown at night, this works very well, and is used to store the extra cars during the "light" hours.

Starting from the upper terminal, or roundhouse, at One Hundred and Fifty-fifth street, on the Ninth Avenue line, the engine brings a train down to the Battery, the lower end or peak of New York. The engine cuts loose, and another engine backs down and pulls the train away as soon as schedule time arrives, which isn't a long wait, and the engine then gets out of the way of the next train. It then waits for the next train to pull in and, when time is up, pulls it away from the other engine and starts on its journey. It does not go far, however—only to the second station, Rector Street, where it uncouples and takes water and coal, waiting for the next train before taking its trip to the upper terminus. This route is about nine miles long, and is run in about 35 minutes, including twenty-five stops—rather lively work for the man at the reverse lever and throttle, to say nothing of the brake.

The fireman does most of his work at the end of the run and on some of the short runs this is the only place he touches the fire. On the run from the Battery to One Hundred and Fifty-fifth street he handled the scoop four times, putting on a little coal each time.

The coal is carried in the bobtail tank, which holds 2,500 pounds of coal and 512 gallons of water. A sliding, hinged door lets the coal on to the deck as wanted, and the fireman keeps the deck clean by letting down just what is needed. Coal consumption averages from 35 to 40 pounds per mile, while water consumption on the Kings County road is given as 26 gallons per mile. Most of the later engines have 12 x 16-inch cylinders, carry about 125 pounds of steam, and weigh from 20 to 25 tons. One of them is shown in Fig. 5.

Some of the curves are rather startling to those not used to this kind of railroading, there being a few as sharp as 90 feet radius, and varying from this to 325 feet. But streets are narrow, and corners must be turned, and there is really little difficulty experienced in doing it. One of the best examples of crookedness is shown in Fig. 6, which is near the South Ferry Station, on the Second and Third

Fig. 4. SHOWING CONSTRUCTION OF LINES.

Avenue lines. We are indebted to Mr. Charles Pollock, of Boston, Mass., for this view, which is very interesting.

The cars regularly used are built especially for the service, and carry, all told, in the neighborhood of half a million people a day on the Manhattan roads alone. They are not peculiar in any way, unless it is the absence of steps, flush platforms, and (with the exception of four seats on each side running crosswise) the seats being placed lengthwise of the car. One of the first styles of cars used is shown in Fig. 7, and this also shows the style of structure then in use, which is quite a contrast from that shown in the other views.

After this narration of details and figures, a trip on one of the engines may be interesting.

Leaving the downtown terminus at South Ferry on a Ninth Avenue line train, we leave Battery Park on the left, with its new Aquarium made of what was formerly Castle Garden, the first glimpse many a good citizen had of his adopted country. We are only fairly started when we stop for Battery Place station; a short stop—eight seconds, perhaps—and we are off again, the next stop being Rector street, where the engines take water and coal, the train being pulled from here by another engine ready to start.

Then we begin to realize what elevated railroading is. As one of our Hibernian friends puts it, "The engineer glues his fisht to the reverse lever, niver lavin' go fur a second, and it kapes him shovin' it back an' forth, like he was runnin' a cross-cut saw insted ov a locomotive." And he isn't far wrong. It's a continued story of many chapters, with the same plot in each—open throttle; hook her up, once, twice; shut off; drop her down; use brake till you stop just right. That's the story that is repeated about every 40 seconds at the lower end of the trip.

Fig. 5. A TYPICAL ELEVATED ENGINE.

Fig. 6. A CROOKED PORTION OF THE ROAD, THIRD AVENUE "L."

Cortlandt street. "Out here for the Pennsylvania Road"; Barclay, "ditto for

D., L. & W. Road," and we begin to crawl uptown, keeping fairly close to North River and the shipping districts.

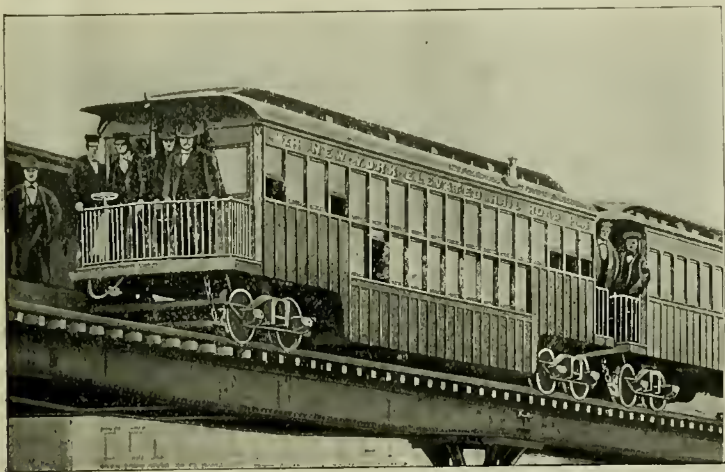


Fig. 7. AN OLD-TIME "L" CAR.

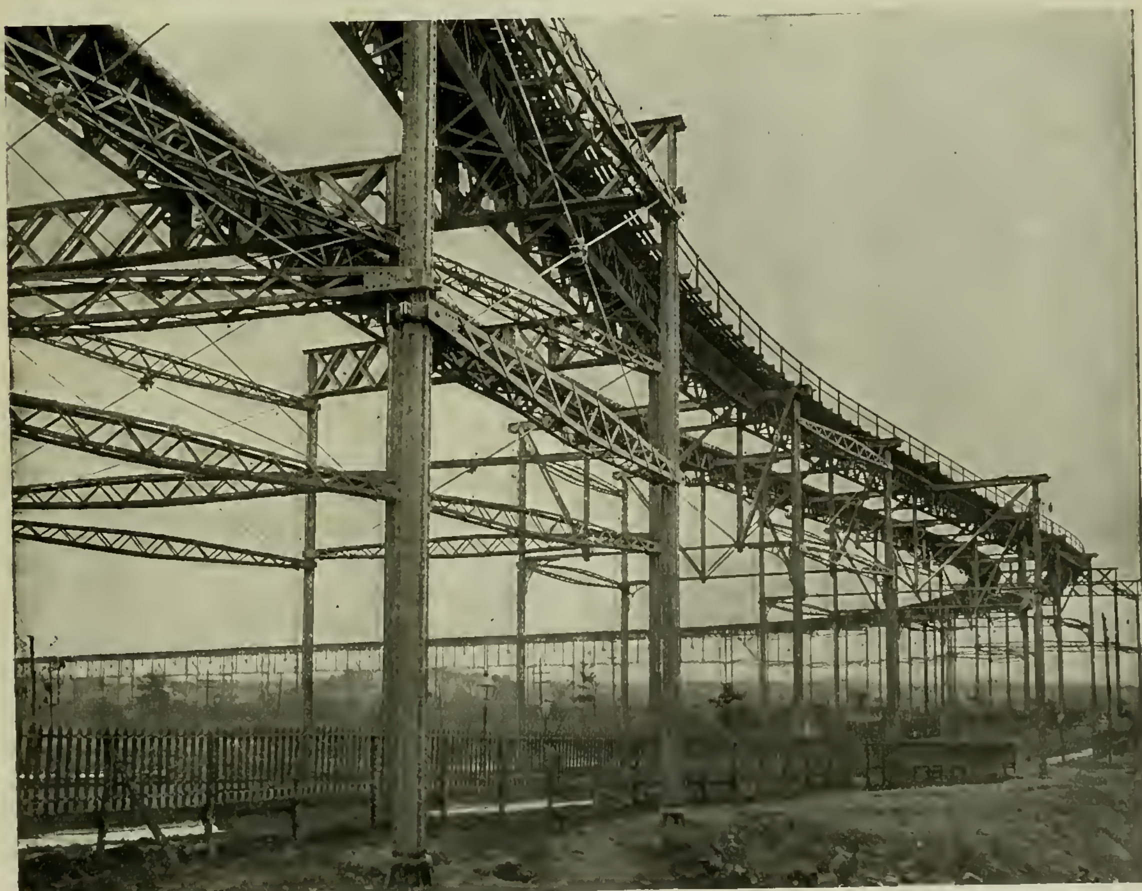


Fig. 8. THE BIG LOOP—ABOUT 50 FEET HIGH.

There is little of interest till we pass Fifty-third street, where the Sixth Avenue line joins the Ninth, and we begin to get into a better portion of the city. To the right we begin to see glimpses of Central Park, and at Eighty-first street the top of the Obelisk can be seen.

At One Hundred and Tenth street the big reverse curve shown in Fig. 8 is reached, and it seems a little peculiar to be railroading at a hight of 57 feet over land, not a river in sight.

At One Hundred and Sixteenth street Figs. 9 and 10 were taken, one to the west, showing Grant's tomb in the distance, and incidentally being over the top of the houses nearest the track. The other shows a "wash out on the line," and gives an idea as to the hight, as well as the method of drying clothes in the tenement houses of New York.

From here to the terminal there is nothing of special interest; but at One Hundred and Fifty-fifth street the terminal shown in Fig. 11 is quite a revelation to the engineer who imagines that the elevated road system is a toy. The view gives an idea of the size as well as the capacity of the coaling station, and the available yard room on stilts; the streets are below it.

It must not be imagined that this trip has been all play, for with a five-car train some of the grades put the engines to quite a test—in fact, it is a series of grades, some slight, some severe, but all requiring care and constant watchfulness on the part of the engineer.

Brooklyn—the City of Churches, of Henry Ward Beecher, and the other half of Greater New York—also has elevated roads (two of them, in fact), and they cross and recross each other as well as

Fig. 9. OVER HOUSES TOWARD GRANT'S TOMB.

Fig. 10. "WASH OUT ON LINE."

Fig. 11. ONE HUNDRED AND FIFTY-FIFTH STREET TERMINAL.

Fig. 12. UP GRADE ON THE KINGS COUNTY "L"—3½ PER CENT.

Fig. 13. ONE OF THE SHARP TURNS ON BROOKLYN "L."

ELEVATED RAILROADING IN NEW YORK.

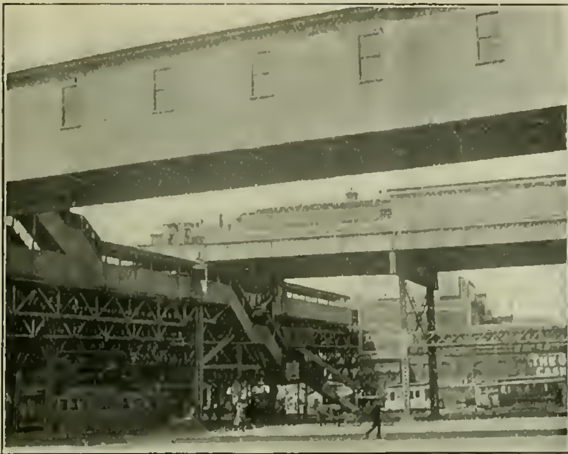


Fig. 14. LOOPS AT BROOKLYN BRIDGE ON BROOKLYN "L."

Fig. 15. SIGNAL TOWER, BROOKLYN "L."

their own branches in a fashion that bewilders a stranger. The Kings County line starts at the Brooklyn end of Fulton Ferry, and has an up-hill job in getting to the end of Brooklyn Bridge. This is where its 3½-per-cent. grade comes in, as is shown in Fig. 12, with its engine puffing up past the semaphore, the Bridge pier in the background, going on to the terminus in East New York. This line carries about 50,000 passengers a day. On the Brooklyn Elevated road we start at the Bridge, with its loop, shown in Fig. 14, and take one of its branches, either East New York or Fifth Avenue lines. Taking the latter as a matter of chance, we wind and twist around curves, as shown in Fig. 13 (which was taken from the rear platform of the first car), over the first story of buildings in some places—although this line hasn't any monopoly patent of this feature—and going near enough to scratch a match on the walls as you pass by.

At Flatbush avenue we go under the Kings County road, before mentioned.

Fig. 18. "CHANGE FOR GRAND CENTRAL DEPOT."

Fig. 16. CHATHAM SQUARE STATION.

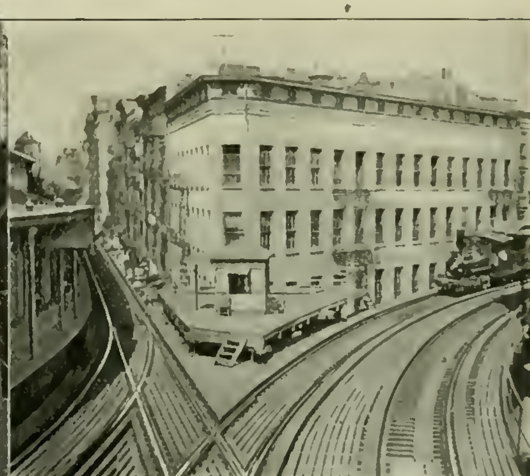


Fig. 17. JUNCTION OF SECOND AND THIRD AVENUE LINES AT CHATHAM SQUARE.

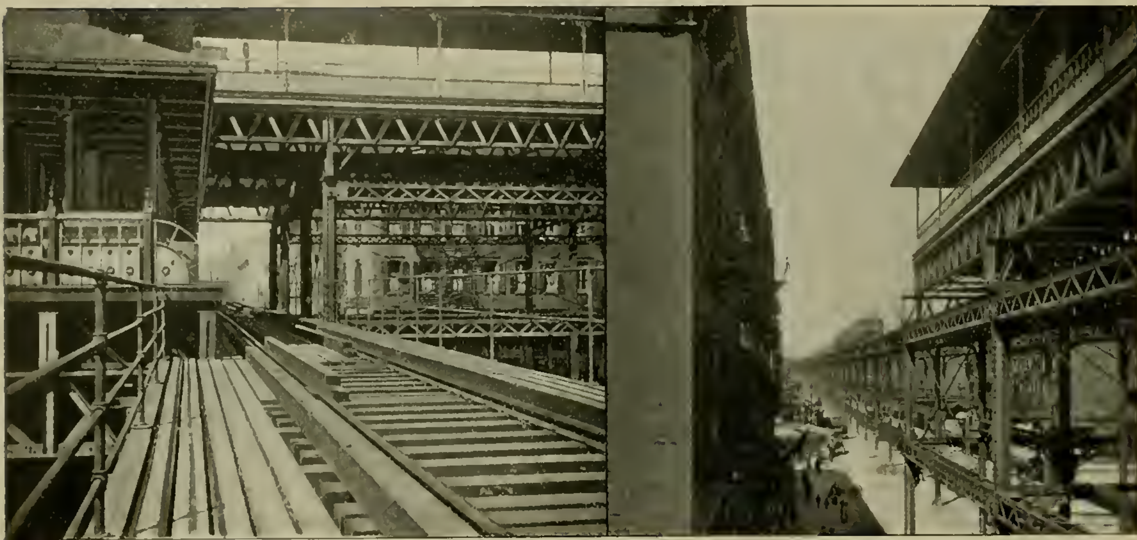


Fig. 19. THIRTY-FOURTH STREET SHUTTLE RUNNING UNDER SECOND AVENUE LINE. LOOKING NORTH ON SECOND AVENUE LINE FROM THIRTY-FOURTH STREET.

and continue our way toward Fort Hamilton, which is interesting just at present on account of the warm reception it is hoped and expected it can give a Spanish fleet which wants to have a "go" at New York.

Getting out in the country again, we pass the far-famed Greenwood Cemetery, and Fig. 15, taken to show the signal tower and switches, just as are used in "real land railroads," gives a small glimpse of Greenwood, on the right. There is much of interest along the Brooklyn lines, but as the operation is very similar to the New York lines (although the Brooklyn lines have a few compound engines in service), we may as well return to wicked Gotham and have a look at her other roads.

The railroading part is very similar on all the lines, but the different sections of the city have at least a passing interest. Taking the Third Avenue line at the Brooklyn Bridge, or City Hall, station, which, being beside "Newspaper Row," is a bedlam in these days of war with Spain, we move up Park Row to Chatham Square, where we can "change for Second avenue or South Ferry," if we choose.

Chatham Square is the junction of the Second and Third Avenue lines, and also of the City Hall and South Ferry branches of these lines, and is a busy station—or stations, for there are really two. Fig. 16 shows one side of the station, while Fig. 17 shows a Second Avenue train nosing around the curve and gives an idea of the switch-work.

This point also marks the beginning of the far-famed Bowery, but the injunction to "Never go there any more" doesn't apply to the elevated roads. At Ninth street we pass Cooper Union, and at Fourteenth street, one of the important "shopping streets," is also the noted Tammany Hall. Twenty-third street is another "shopping" street, and soon we hear "Thirty-fourth street; change for Long Island Railroad," and we see a road running at right angles to our own. These are called "shuttle trains," and run only between Third avenue and East River, a distance of perhaps three-quarters of a mile.

At the next station, Forty-second street, it is "Change for the Grand Central," and passengers pass over the bridge shown in Fig. 18 to another shuttle road, shorter than the other, which lands them under cover at the depot named.

From here to One Hundred and Twenty-ninth street, the end of this division, it is the same old story of ups and downs, and on some of the downs the train attains a pretty lively speed. At Ninety-ninth street are the repair shops and coal-

Fig. 20. UP THE ROAD. RUNNING CLOSE TO HOUSES—CENTRAL STATION IN DISTANCE.

ing station of this branch, but not so large as the one shown before.

If we had taken the Second avenue line and got off at Thirty-fourth street, we would have seen the "shuttle" down below us, and Fig. 19 shows how the shuttle runs under the Second Avenue line, as well as gives an idea of the hight and appearance of the bridge-like structure, looking north. Both the Second and Third Avenue lines come to the same terminus at One Hundred and Twenty-ninth street.

While we are out we want to see the whole route, so changing cars at One Hundred and Twenty-ninth street, we take the extension line and cross the Harlem River on a drawbridge, and, after making a couple of curves, start north again. There are many frame houses here, and Fig. 20 shows how closely we run to some of them—not a good place to have your head or arms out of the window. This view also shows a station between the tracks, but at such a distance as to make it appear rather small.

The other view gives an idea of the track of an elevated road, with its curves and apparent lack of protection from dropping down into the street and smashing somebody's new hat. In reality, however, they are well guarded by the use of heavy timbers each side of the rail. These timbers are about 6 by 9 inches and are bolted down solidly to the structure, so that even if an engine or car jumps the track, which is seldom, it is practically impossible for it to climb over the guard timbers. These have proved themselves so safe that accidents of this kind are practically unknown.

This part of the town is rather thinly populated as compared with the lower portion of the city, and we are drawing toward the end of the longest line, at One Hundred and Seventy-seventh street. This is simply the jumping-off place, and the only supply to be had is water—the only one needed, however, as One Hundred and Twenty-ninth street is a "division point." And as this is the terminus of the road, we will also let it serve the same purpose for this rambling description.

JUMPING-OFF PLACE.

Filling the Boiler Under Difficulties.

If any correspondent was to send in the following question, we would be inclined to think that it was a theoretical catch question; yet during the course of a visit to this office the superintendent of motive power of a Western railroad told us that it had received a practical solution lately from an engineer on his road. The question is: "If your left-hand injector was not in working order and the goose-neck on the right-hand side of the tank got broken off, what would you do to take in the train?"

That was the predicament which an engineer found himself in. He did not dump the fire and wait to be towed in. Instead of that he put his thinking mechanism into full working order, with this result: He went to a neighboring section-house and borrowed a washing-tub. That he fastened under the hole in the tank where the goose-neck ought to have been and secured the end of the feed-pipe hose in the tub. Water was run into tub and injector started. It was kept going until the boiler was full, then a start was made. They ran as far as they could on the water in the boiler and then stopped and filled up again. The process caused some delay but it was far ahead of waiting to be towed in.

Smoke Motive Power.

"Recently," says the Boston *Herald*, "two gentlemen, driving in a wagonette, were smoking, when a spark falling from one of their cigars set fire to some straw at the bottom of the carriage.

"The flames soon drove them from their seats, and while they were extinguishing the fire a countryman, who had for some time been following them on horseback, alighted to assist them.

"'I have been watching the smoke for some time,' said he.

"'Why, then, did you not give us notice?' asked the astonished travelers.

"'Well,' responded the man, 'there are so many new-fangled notions nowadays I thought you were going by steam.'"

Lake Shore Annual Report.

From the Annual Report of the Lake Shore & Michigan Southern, recently received through the courtesy of Mr. R. H. Hill, auditor, we learn that at the end of the last year the company owned 421 passenger train cars, 18,711 freight cars and 710 working cars. The manner in which this company's cars are kept up may be judged from the fact that during the year 26,753 new wheels and 2,432 new axles were applied to cars. The cost for maintenance and new cars was $278,362 for passenger equipment and $783,179 for freight. During the year 2,473,436,580 tons of freight were carried one mile, an increase of 4.06 per cent. over the business done the previous year. The number of passengers carried one mile was 210,487,402, a decrease of 0.3 per cent. compared to the previous year. The average distance that passengers were carried was 49 miles, and the average amount received from each passenger was 98.8 cents.

During the year the company bought 20 locomotives, 7 passenger cars and 60 freight cars. The mileage made by locomotives was 18,064,790, or 34,874 per engine. Repairs cost 5.02 cents, wages were 7.15 cents, fuel 5.84 cents and lubricants 0.18 cent per mile run. The average distance run to the ton of coal was 24.97 miles.

There is a story told about the locomotive valve motion model which LOCOMOTIVE ENGINEERING is offering for the modest sum of $60, or for seventy-five subscriptions for one year. At one time the firemen at New Haven, Conn., bought a model and installed it in the hall where they meet. The Order of Elks also met in the same hall, and the firemen considered it wise to have their model boxed up so that the Elks should not be able to butt it out of shape. A carpenter was employed to make a box that would take up as little room as possible. When he finished the job the covering of the model had a striking resemblance to a coffin set up on legs. A few days after the work had been done the Buck-Elk sent for the master of the fireman's lodge and told him that the Elks were not hiring their hall as an undertaker's establishment. They had a little banquet after their last meeting and the proceedings resembled a funeral. The coffin seemed to stare them all in the face, like Banquo's ghost. The lodge unanimously voted for its removal on the grounds that the hall was not rented to be used as a vault.

Again the bicycle in the "baggage-van" bobs up again on the other side. The Furness Railway has some new "vans" with a special platform at one end for six wheels. Each one fits into a separate leather-padded groove, and straps keep them in position and free from injury. The raised platform keeps them separate from other baggage. This scheme is credited to Mr. W. F. Pettigrew, superintendent of the locomotive and carriage department.

We noticed lately in a hand-book giving information about engineering matters the statement made that the average locomotive used 3,000 gallons of water for every 100 miles run. In our day the quantity really used was about four times that, and eight times 3,000 gallons comes a little nearer the mark for modern freight trains.

A Roundhouse Yarn—Warned by a Farmer.

"You have often heard tell how a man's attention is sometimes called to a trivial thing when Death is staring him in the face and he expects every breath to be his last," said Pete, as he "hitched" himself so the grateful warmth from the roundhouse stove could get to a fresh surface. "Well, that is just the experience I had when I had been firing about three months."

"We were galloping along about forty miles an hour to get a swing for the hill with the twenty-five loads, and I was watching a farmer, a quarter of a mile away, plowing, when the side rod on my side 'let go,' knocking the seat and myself striking the rocky ground, at the rate we were going. As 'Old Stripes'' hand touched me, I distinctly saw the farmer waving frantically, and the humorous thought flashed through my mind: I wonder if he thinks we don't know we are in trouble.

"As I scrambled back over the pile of coal and onto the head car and began winding up the brakes, I watched the 'haybinder,' from the corner of my eye, now running across the curve to head us off, hat in hand, 'swinging us down' and yelling at every jump.

"We finally stopped, and I went forward and was with 'Old Stripes,' looking over the damage, when the 'haybinder,' with his face crimson from his exertions, rushed up and breathlessly exclaimed:

"'Say! they's something the matter with your engine.' 'The h——,' said 'Old Stripes,' in a most discouragingly sarcastic way.

"'Yes, there is,' said the farmer. 'I was plowin' over in the field, when I seed somethin' begin goin' round and round, just like a flail, and I knowed you ort to be notified at once.'"

Fads and Fancies—No. 6.

This is an American production, and though the idea was not new (as a similar contraption and attempt to fool steam into doing double duty had been proposed before), this is probably the first attempt to force it on the unsuspecting public. It was designed and patented by Eugene Fontaine, of Detroit, in 1880, and had a short life of alleged popularity. It was tried on several roads, but its adoption as a practical device has not yet been recorded.

It had cylinders 16 by 24 inches, 70-inch drivers, "geared up" by having the upper friction wheels 72 inches and the lower ones 56 inches, making it equivalent to a 90-inch driver, or a "90 gear," as the bicycle fiend has it. The engine weighed 93,000 pounds, with 44,000 pounds on the drivers, and had an air cylinder to increase contact pressure between the friction wheels.

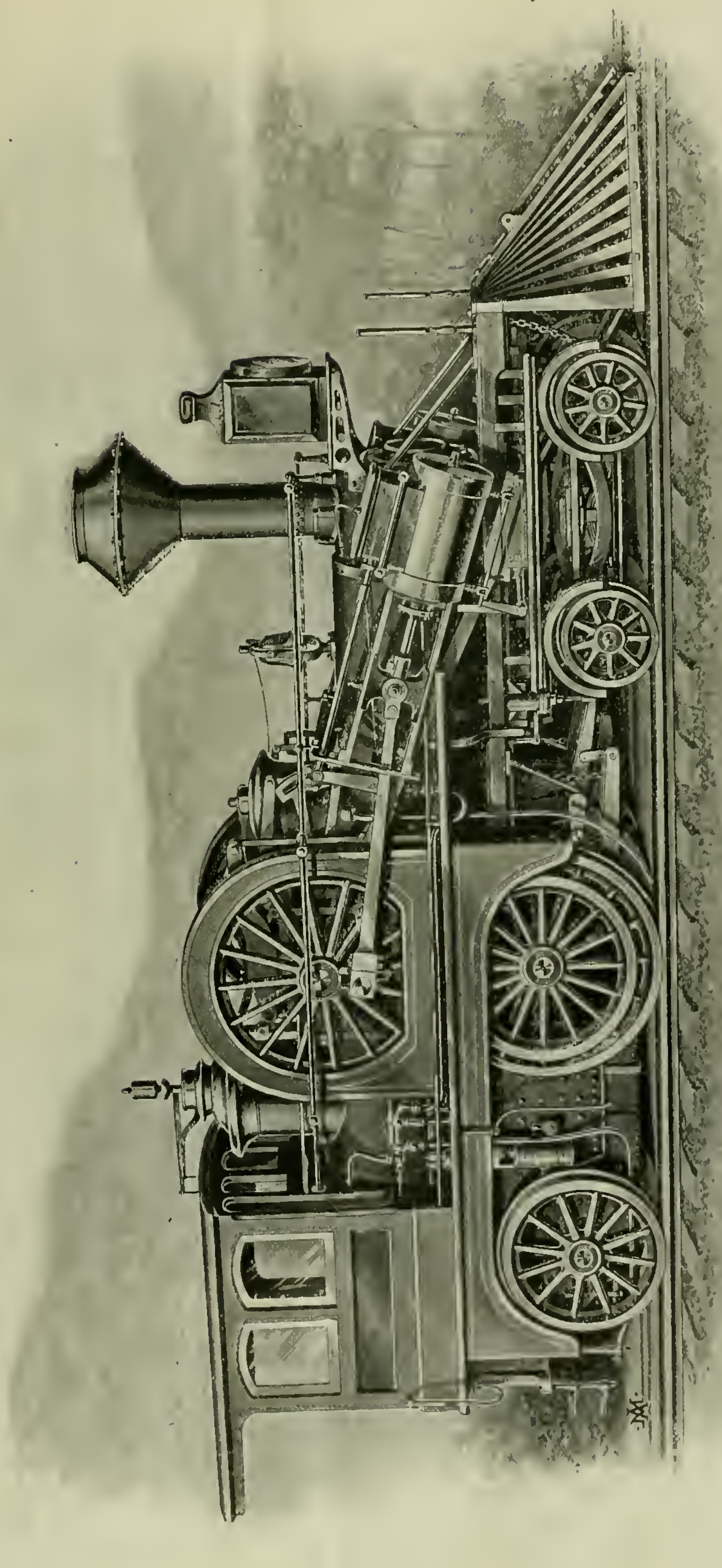
PURDUE LOCOMOTIVE WITH SENIOR CLASS.

on it to the deck in an instant. The pieces still hanging to the crank pins demolished the running board and that side of the cab, and whenever they hit the ground and ties just right, lifted the drivers off the rails till it seemed as though the engine must surely tip over. As 'Old Stripes,' the engineer, shut off and 'squealed for brakes,' I was aroused from the temporary paralysis I was momentarily thrown into by the shock, and started for the gangway to get off on the high side as quickly as the Lord would let me.

"'Old Stripes' grabbed me by the shoulder and yelled 'Get back on the train!' thus saving my life, undoubtedly; for if I had successfully dodged the flying rods, I would surely have been killed by

From a very exhaustive report perpared some years ago concerning the breakage of car and locomotive axles, we note that in 150 breakages, 68 were in journals, 37 in the wheel seat, 29 close to the wheel seat, and 16 in the middle.

The evils of forging with too light a hammer are very forcibly shown in an article by H. F. J. Porter in the Franklin Institute *Journal*. Views are given which show breaks in various sized shafts—from 12 to 15 inches in diameter—with hollow or crystalline centers, even though the hammer had a falling weight of 10 tons. The moral is to use a hammer heavy enough in forging your car and engine axles, so that many of the mysterious failures may be avoided.



FADS AND FANCIES IN LOCOMOTIVE BUILDING—No. 6.
THE "FONTAINE," 1880.

Scenes on Queensland Railway.

The scenes on a Queensland railway, shown on the following pages, were reproduced from photographs sent us by Mr. Frank Anschan, an engineer on the road. A letter which accompanied the photograph reads:

"Enclosed under separate cover please find views taken on a new section which has been opened on our north coast line, thus making a grand trunk of 327 miles north from our capital city of Brisbane, with a southern main line which connects with New South Wales of 232 miles—total, 559 miles of main line, with a number of branch lines varying from 19 to 400 miles long. The iron structures, I may say, have all been made here in our own town of Maryborough, and may be of interest to some of your readers.

"The live-stock special train was taken at the head of our old road before the new extension was opened. The engine is the one I have had for the last four years, and the party in the front is your humble servant."

On the Panama Railroad.

They have discovered a manganese mine in Panama which is more valuable to its owners than the average gold mine. Mr. John K. Cowen, receiver of the Baltimore & Ohio, is the principal owner. A visit was recently paid to the locality by Mr. Frank G. Carpenter, who has published a vivid and interesting description of what he saw. Of a trip on the Panama Railroad he writes:

"The ride across the isthmus is a delightful one. The country, after you pass the few miles of lowland on the Atlantic side, rises into many wooded hills, and the distant views make you think of the forest-covered rolling lands of the United States rather than of the tropics. There are few palm trees, though you now and then pass a banana plantation. You go by villages of thatched huts and the buildings of the canal people are everywhere to be seen. The road runs very smoothly and the track is well kept. It is a 5-foot gage equipped with lignum vitae ties and 56-pound rails. These ties are about the only ones, except iron, which will withstand the attack of the wood-eating ants which are found here. They are from trees so small that a tree seldom furnishes more than one tie, and the wood is so hard that spikes cannot be driven into it. Holes have to be bored for every bolt, and extra work makes the ties expensive. Each one costs about $1.80 in silver. The telegraph poles are of iron. All of the rolling stock comes from the United States. The superintendent's private ob-

SCENES ON QUEENSLAND RAILWAY.

servation car, in which we rode, was made in Wilmington, and some of the locomotives came from Philadelphia. The first-class cars have wicker seats, like those of some of our smoking cars. The second-class are built like long street cars, with the seats running lengthwise under the windows. I rode for some time second class to see the people. Half of the passengers were Jamaica negroes, one-third was made up of Chinese, and the rest were native Colombians. The Chinese were the best dressed of the lot, and the neatest. As the American conductor came in I asked him as to his health, and was told that he had been traveling over the road for seven years and had not been sick a day.

"All wages of Americans are paid in gold, and those of the common laborers in silver. Engineers get $157 a month, conductors $148 a month, and telegraph operators from $75 to $100. The brakemen are natives, and they receive $1.75 a day in silver. Common laborers get from 35 to 75 cents a day, and most of those who work on the tracks are Jamaica negroes. They put in ten hours a day, beginning at 6 A. M. and working until 11. Most of them bring their first meal of coffee and bread to the track and eat it there. At 11 they stop for breakfast, which is usually made up of rice and a bit of dried meat, and at 1 go to work again and work until 6, when they go home for dinner."

Carrying "Locomotive Engineering" to China by Mistake.

One of the latest annoyances to worry the hearts of LOCOMOTIVE ENGINEERING staff is the postal card or letter which says: "I have not received the paper for last month." We use every care that we can devise to avoid giving cause for this complaint, but yet it continues to reach us, although in decreasing strength. We believe that the Post Office people are responsible for non-delivery of some papers, but it is difficult to locate the culprit.

A specific complaint of this kind reaches us from Honolulu. An agent there says that a bag of mail intended for the Hawaiian Islands had been carried to China, and it was the second time that the delivery of LOCOMOTIVE ENGINEERING had been delayed because it made that long journey. This is a species of carelessness that is beyond our control, and all that we can do is to grin and bear it. We trust the other sufferers will do so likewise.

Norwood Shops of the New England.

A very interesting railroad shop is that of the New England Railroad at Norwood Central, Mass., an unpretentious little plant, but one fully abreast of the times in everything going to make a successful general management. The advantages of piece-work are well understood here, for it has been found to work most satisfactorily for both the road and the men.

It is an infallible sign of a proper executive officer, to find a clean shop, and by that gage we were not disappointed when coming in touch with Mr. Kearsley, the general master mechanic of the road. The inside walls of all the shops are kept covered with whitewash—blacksmith shop included. The effect is somewhat startling to find shops as bright and clean as these, after groping through some others afflicted with a murky gloom that is dispelled only by a torch.

This blacksmith shop was at one time the cause of much annoyance and grief to the men, on account of the failure of every plan to relieve it of the smoke and gases. All kinds of hoods were tried over the forge fires, even those with concentric openings, which are supposed to have some occult connection with in-

SCENES ON QUEENSLAND RAILWAY.

duced currents. Two exhaust fans were also placed in the roof lantern, and these failed to rid the shop of the noxious fumes. As a last resort the hood pipes over the fires were made to enter the chimney a few feet higher than before, and the whole trouble ceased at once—the air becoming clear in a few minutes after starting the fires in the morning, and remaining so.

The inference to be gathered from this is, that there must be some definite distance relation between the top of the forge and the outlet of the hood, in which the area of the pipe is an element also to be considered. If this view is correct, it would pay to investigate the wherefore of this satisfactory change in atmospheric conditions, and determine just what these ratios are. We know that many cases of the kind have been cured by pure guesswork, and many others that still endanger the health of the men, after expensive appliances have been tried and failed to take out the smoke. The opportunity is open for someone to give up reliable data concerning correct piping of forges for natural up draft, as is now done with down draft.

To return to the shops: Air pumps served their purpose in furnishing compressed air for the various shop uses, until the wall would hold no more pumps, and it resolved itself, as in so many instances before, into a case of buy or build a compressor. The latter was done by extending the piston of the stationary engine into a 10 x 60-inch compressing cylinder. Like many of the New England shops, this has some few old tools that can't be sold nor given away, and it would be a sacrilege perhaps to do either with the old single-head driving wheel lathe that has seen forty-five years of shop life. It has been replaced long ago by a modern tool, and stands now much in the light of an old horse turned out to graze; there are many of the boys who would be sorry to see it broken up. The whitening of the walls at these shops, it is proper to state, is done by the compressed air-spray method, which makes it possible to have light and clean shops at a low cost.

SCENES ON QUEENSLAND RAILWAY.

Clean Engines and Cabs.

BY R. E. MARKS.

John Duzenbury had called up one of the firemen for a lecture for not taking good care of his engine and for burning too much coal—more than he used to when he fired for Jack Sharp. The inquisition was on when I dropped in, and I just heard young Frank Burdick say:

"Yes, I know it, Mr. Duzenbury; know we're burning too much coal; know the old '21' looks like a hog-pen and a hen-roost combined, and I'm just as ashamed of her as you can be. But you fire for Jake Dummit two weeks, and I'll bet you'll do just the same as I do—shovel coal and let her stay dirty.

"You didn't have any trouble when I fired for Jack Sharp; did you, Mr. Duzenbury? Didn't the engine look clean, and wasn't the coal record all right?"

Duzenbury admitted it was all right before, and wanted to know why there should be any difference now.

"Guess you've never ridden with Jake Dummit, or you wouldn't ask," said Burdick. "Well, I'll tell you, though I don't like to kick on an engineer.

"Jake hasn't half as much judgment as a cow, and he don't care a continental about anything except the end of his run and pay-day.

"He lets the injector soak her so full she slops out the stack, ruins the looks of the jacket and washes the oil off the valves. Then he pulls the throttle clear out into the tank and tries to run by the reverse lever entirely. I know some men say that's the only way to run; but if they'd fired for both the men I have, they'd change their mind mighty sudden.

"Jake's running will knock any coal pile out in one round. He don't look at the gage at all, unless he thinks he's running too slow. Then if it happens to be down a little, due to his overdose of water and wide throttle, he enjoys himself swearing at me.

"If you haven't seen the inside of the cab of the '17,' you don't know how dirty she is, Mr. Duzenbury, at least on Jake's side. He's a chewer from 'way back; eats about a pound of tobacco a day, or maybe not over 15 ounces, and every bit of juice he's squeezed out of it since he got the '17' to run is plastered on the front end of his side of the cab. He don't care whether it's ever cleaned or not, and I'll be jiggered if I'll clean it anyway. That's why I don't keep things looking better.

"Now about coal: When I fired for Jack Sharp he used to watch the steam gage just as close as I did, and he'd ease off on the throttle when for any reason she commenced to drop. He ran by the throttle after he found where the '81' would do the best, and he wouldn't flood the boiler just at the wrong time either.

"We burnt less coal than any train on the road, and it was largely due to both of us working together; for either one can knock the savings of the other higher than a kite. Jack saved as much as I did, or more, and I only wish I was firing for him now. He's a runner, he is."

Duzenbury thought it all over, gave Burdick another run, and made Jake Dummit clean out his cab, under penalty of discharge.

There's a whole heap of truth in what the young fireman said, and I don't believe it will be very long before he has an engine to run, now that John knows the facts of the case.

Mistook the Soup for Coffee.

A new railroad was opened up the other day in a Vermont town, and in honor of the event the company entertained some of the prominent residents of the locality. Bouillon was the first entrée. It was served in teacups, as is said to be the proper style. The first trustee took it for coffee, called for sugar and milk, and used them, passing them on to the second trustee, who followed his example, and passed them to the third, who helped himself, and handed them to the next, who, in turn, milked and sweetened his cup and passed them on to the editor, who took the contents of his cup to be tea, and took milk only, and passed to the clerk, thence to the president and the rest of the officials, and then somebody said "Soup," and thereafter nobody thought he cared much for bouillon anyway; and now if you ask one of them, "Do you take sugar and milk in your bouillon?" an explosion occurs.

A Fire Inspector.

The Chicago & Northwestern management have appointed a new official who is called fire inspector. His duties will be inspection with the view of preventing fires, and we are strongly of the opinion that no man on the railroad will earn his wages with greater benefit to his employers. He will be charged with the duty of inspecting all buildings and structures of the company in a thorough and systematic manner, with special reference to risk and danger from fire. The inspection will extend to the methods used in handling and storing fuel, oil, ashes, waste and other combustible material and supplies; the handling, care and cleaning of all lamps; the care of stoves, heating and lighting arrangements; the care taken of the company's building and structures to prevent risk or danger from fire, and the appliances provided for fire protection. He will report to and receive his instructions from the general superintendent.

A Good Story, but Hard to Believe.

A recent railroad wreck in North Carolina was caused in a peculiar way, says the *Atlanta Constitution*. A colored man wanted to get a ride and tried to jump a train of empty flat cars. He missed the car and fell across the track, where the wheels of several of the cars passed directly over him. His body threw two of the cars off the track, and the strangest part of it is that after the cars had run over him, the man was able to get up and walk away. As he looked around him he was heard to exclaim:

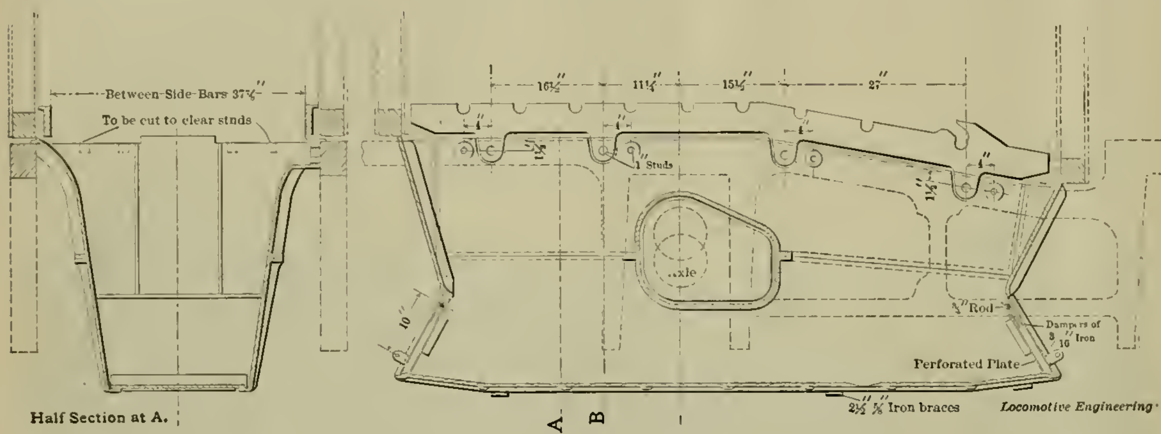
"Well, well! I never see de like sence I wuz bo'n. I'll bet my week's wages dat railroad'll sue me fer damages!"—*The Railroad Employee.*

The "air" crank has his inning now, and he has a bicycle which is encumbered with an air pump, and consequently an air motor to do the driving. This is a little better than the electrical machine, because it ought to be lighter; but the fellow that "kicks" either of them up a hill will wish he had the old-fashioned chain, with its dirt, unmechanical features and all. Nearly every form of motor has its field, but no one kind is adapted to all fields

SCENES ON QUEENSLAND RAILWAY.

Cast-Iron Ash Pan.

Some years ago, when Mr. Monkhouse was assistant superintendent of motive power of the Chicago, Rock Island & Pacific Railway, we examined the cast-iron ash pans introduced by him on eight-wheel engines at Horton, Kansas, and the results were in every way satisfactory. It was only natural, when called upon to take charge of the machinery department of the Chicago & Alton, for Mr. Monk-



CAST-IRON ASH PANS.

house to bring with him, among other good things, this ash pan. On the Alton the idea has been advanced one step further and adapted to ten-wheel or other engines, where the pan has to span the axles. Concerning this latter, a letter from Mr. Monkhouse says: "The cost, applied to engine, is $27.50. Of this, $25 covers material and the balance represents labor applying ash pan and side rests for grate bars. The ash pan and grate bar rests go up together, and rightfully only $1.50 should be directly charged to cost of applying the pan."

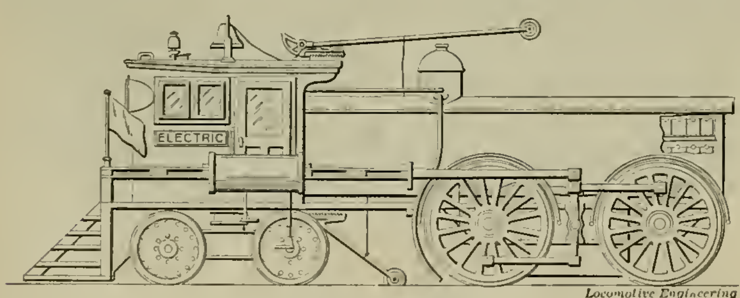
The old-style steel pans cost $33.50, with $3.50 additional for labor applying to engine; or in all, $37, or $9.50 more than the cast-iron pan. This, in itself, is a consideration in favor of the cast-iron pan; but when you come to take into account the difference in cost in making repairs to mud-rings, this is quite insignificant. With sheet-steel or iron pans from four to six men are necessary to take the pans down, and it is very cumbersome and awkward to handle, often consuming a half-day's time to get it down to perform fifteen minutes' work on a mud-ring, and about as much time in addition to readjust it to the engine.

Particular attention to the details of the cast-iron pan will develop the fact that it can be removed or taken apart in sections, and the removal of all or any part thereof is well within the capacity of two men to perform the work. In most cases, it is only necessary to remove the front and back portions to get at the corners of the mud-ring, which is, in fact, the only place on the mud ring that requires repairs. From what has been said concerning the cast-iron pan, its great advantages are quite plain, both on the grounds of first cost as well as time consumed in making repairs. The average life of a sheet-iron ash pan is about two years. Mr. Monkhouse says he is unable to say what is the average life of the cast-iron pan, as he never has succeeded in wearing one of them out, for the first cast-iron pans applied seven years ago are still in service, and show no evidence of warping or much damage from corrosion.

A New Electric What-Is-It?

Ever since the first electrical enthusiast hustled all the steam locomotives into the scrap heap—on paper—we have been regaled with the disadvantages of the reciprocating parts of a locomotive with the "hammer blow" and various other defects, real or imaginary.

The electric motor was vastly superior because it did away with all these objections at "one fell swoop." Rotary motion was the only perfect device, and the rotary steam motor not being a howling success, the electric motor was the only way out of the difficulty. The rotary motion of the electric motor gave it such a grip on the future of railroading that its immediate adoption seemed certain.



AN ELECTRIC WHAT-IS-IT?

We find, however, that this was all wrong, and that the early inventors, Thomson, Edison and the rest, were not up to date, and their rotary ideas were twisted. The reciprocating business was all right, if you only had the right reciprocator. Steam was a fizzle, of course. The locomotive was too expensive, burned too much coal, needed a man who was worth over $1.37 a day, and had other defects.

By just using electricity to do the reciprocating—all this is overcome, and the perfect engine has been found, as the cut shows. The company who are exploiting the device very modestly withhold their name, but say that a model can be seen at room 302, No. 7 Water street, Boston, Mass.

It is so constructed that the power is supplied by what is called a "solenoid" by electricians, which means that the iron piston or plunger is drawn or "sucked" from end to end of the cylinder by the windings of a series of hollow magnets. Needless to say, it is the weakest form of an electric motor and will require more current per horse power than any of the rotary motors.

A glance at the circular shows that

whoever wrote it knew mighty little about electricity, or steam either, and some of the statements are amusing, to put it mildly. Here's one gem: "Instead of making small driving-wheels for freight engines, which is done to get the crank pin nearer the rim of the wheel, we move the crank-pin nearer without decreasing the size of the wheel, gaining in power as the square of the distance moved out; thus will get over more ground with a larger load in the same time."

They are to do this by having a first mortgage on the ability to make a long-stroke engine. The "square of the distance" they probably read somewhere, and thinking it sounded well, put it in. It will amuse mathematicians, and does no harm.

They also state:

"This motor is so constructed that almost an unlimited amount of power can be obtained and used directly on the driving-wheels. This cannot be said of a rotary motor, as the lowest possible speed of a rotary motor is about 900 revolutions per minute, making gearing necessary, thus losing power. The reciprocating engine can be run at from twenty-five to 300 revolutions at will."

There probably isn't a single fact in this whole statement. Electric motors are frequently built without gearing, being built on the axles—the Baltimore tunnel motors, the London underground road and others. They can be made to run at any desired practical speed, regardless of the "900" limit imposed. Our friends also expect to run 150 miles a hour, but at only 100 miles and a seven-foot wheel, they must make approximately 400 revolutions per minute—100 more than their own estimate of its capacity. The facts(?) don't agree worth a cent.

The original feature of the engine is said to be the method of applying current. In reality, it is an old application, the one used in electric rock drills, in arc lamps, and in current regulators, but probably the promoters of the new alleged locomotive are not aware of it.

The engine complete is to weigh eighty tons and can be used with the trolley, third rail or storage battery—the latter is recommended as the most economical, which will be another revelation to electrical engineers of the old school. They also take up the abandoned idea of magnetizing the rail to prevent slipping.

They also say:

"A storage battery company has offered to post a forfeit of $5,000 that they will furnish one set of storage batteries to run our engine and three cars to Chicago (from Boston) and back to Boston without being charged" (recharged, they mean, of course).

No reputable storage battery company will guarantee anything of the sort, as a storage battery with a sufficient capacity to run an eighty-ton engine and three cars 2,000 miles would weigh more than the engine could pull or the three cars could carry. It is safe to say the $5,000 will never be posted.

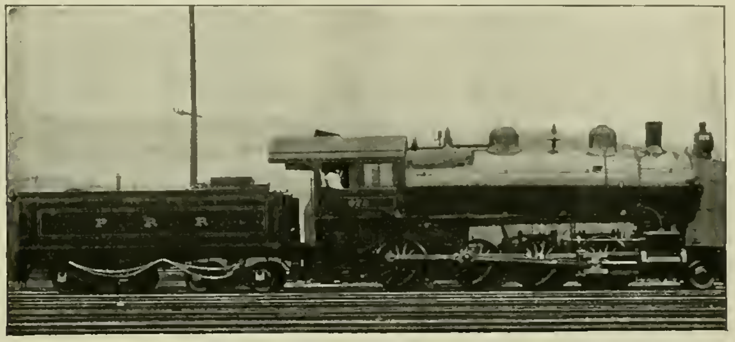
We refrain from any attempt at criticism of its mechanical features, which are, to say the least, fearfully and wonderfully made, for the whole thing, from the alleged invention to the circular issued, would hardly do credit to a schoolboy.

The favorite "water-power-that-don't-cost-a-cent" scheme is also revived, and they say:

"Nearly every railroad has water power along its line. A turbine wheel can be used to drive dynamos to charge the batteries, and power can be obtained at almost nothing in comparison to steam."

Water power is all right—when you have enough of it, but there are very few roads that have water power on their lines capable of hauling a tenth part of their traffic. A horse-power is a horse-power, whether in the form of a dilapidated mule or a reciprocating electric motor, and it takes a good many horse-powers to haul a train sixty miles an hour.

Although no mention is made of disposing of this valuable scheme, there is "stock" written all over it, and those who buy will be apt to think it should have been spelled with a "u" instead of an "o."



NEW PENNSYLVANIA CONSOLIDATION ENGINE.
(Description on page 294.)

Shandy Maguire Amusing His Friends.

While the Brotherhood of Locomotive Engineers were holding their convention at St. Louis, the Ladies' Auxiliary gave an entertainment, at which Shandy Maguire recited, in masterly style, an original poem describing his experience in learning to ride the bicycle. Shandy is a great favorite with those who attend the engineers' convention, as he well deserves to be. He is a most powerful, humorous and amusing speaker. Although he began to speak at nearly midnight, after a woman had bored the meeting for forty minutes uttering mere claptrap, Shandy wakened up the nodding crowd with his witticisms and put them into excellent humor.

In the course of his prose remarks, Shandy took occasion to repeat his challenge to his friend Angus Sinclair, to a bicycle race. He expressed the opinion that Angus was placing too much reliance upon Dixon's Graphite to help in speed-making, and he (Shandy) was prepared to run the race on pure muscle. He knew that if his antagonist agreed to run the race he would keep his word, for Scotchmen were noted for doing that. They were famous for keeping the Sabbath and everything else they got their hands on. One of them, his excellent friend Brother Arthur, had taken hold of the Brotherhood twenty-four years ago, and had kept it ever since.

A Good Record for Gland Packing.

In reply to a question respecting the life of gland packing rings, the United States Metallic Packing Co. writes us:

"In reply to your favor of the 2d inst., we beg to quote you from a letter we have just received from Mr. John Bean, M. M., C. S. & S. He states that engine No. 45 went into service November 19th, 1888, and has made about 425,000 miles. The rods were originally two and three-quarter inches in diameter and have never been turned off, having worn in all that time only three-sixty-fourths of an inch. He further states that the rods were removed, not on account of the wear of the rods, but because the pistons had become too small for the cylinders. He does not state how many different sets of metal for packing he had used. The engine, he states, went into the shop last week."

One of the neatest "war" reminders we have seen is a blotter from the India Alkali Works, Boston. On the smooth side it contains an American flag, in colors, and a fine portrait of Admiral Dewey The only advertisement on it is: "Remember the Name: For General Cleaning—SAVOGRAN; For Special Cleaning—DEWEY."

The First Mason Engines.

Probably no one man made more of a lasting impression on American locomotives than Mr. William Mason, who used good features from many sources, as well as designing many himself, and we are sure the following letter from Mr. Reuben Wells, superintendent of the Rogers Locomotive Works, Paterson, N. J., will be highly appreciated:

"I was master mechanic of what was then called the Jeffersonville Railroad, in 1853, when the first locomotive built by Mr. Mason at Taunton, Mass., was received on the road. At any rate, I have always understood that it was the first locomotive turned out of those works. It was received on the road in the fall of the year; was named the 'James Guthrie,' for one of the directors of the road, and Secretary of the Treasury under President Pierce. The engine was of the eight-wheel American type. Cylinders were 13½ x 22 inches; drivers, 66 inches diameter; weight, about 60,000 pounds.

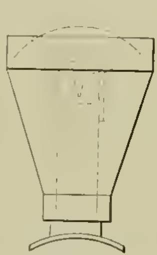


Fig. 1

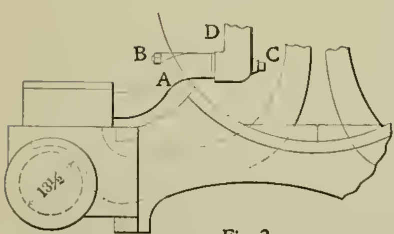


Fig. 2

The cylinders were horizontal and were interchangeable, but bolted to a cast-iron 'saddle,' in whose upper face the smokebox rested and to which it was bolted. The cylinders were attached to this saddle at the frames, one bar of which passed under and the other over this saddle at the point where the cylinders were attached, and all were bolted together there. The inside face of the cylinder and face of saddle where they joined made the joint for the exhaust passage, the latter extending inward and upward to the base of the exhaust pipes, which were 'double,' and their tips as high as the top row of tubes.

"The engine was a wood burner and had the old-style large top stack, with cone and bonnet in its top, about as shown in Fig. 1. The steam chests had a 'gooseneck' extension, from their inner side into the smokebox at *A*, Fig. 2, to which the steam pipe was secured by one bolt through the steam passage *B* to *C*. The head and nut were 'balled' to make the joints, and a cast-iron ring, flat on one face and balled on the other, made the joint at *D*.

"The valves were, of course, not balanced; were made with a 'notch' for an H-shaped valve stem, as shown in Fig. 3. The valve stem had a sleeve and jam nuts with right and left threads outside

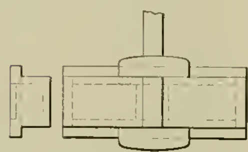


Fig. 3

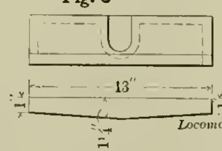


Fig. 4

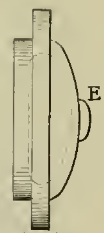


Fig. 5

beyond the gland of the stuffing box. The steam ports were made taper (outwards), as at Fig. 4; were about 13 inches long, 1 inch wide at the ends, 1¼ at the middle, where there was a 'bridge,' as shown.

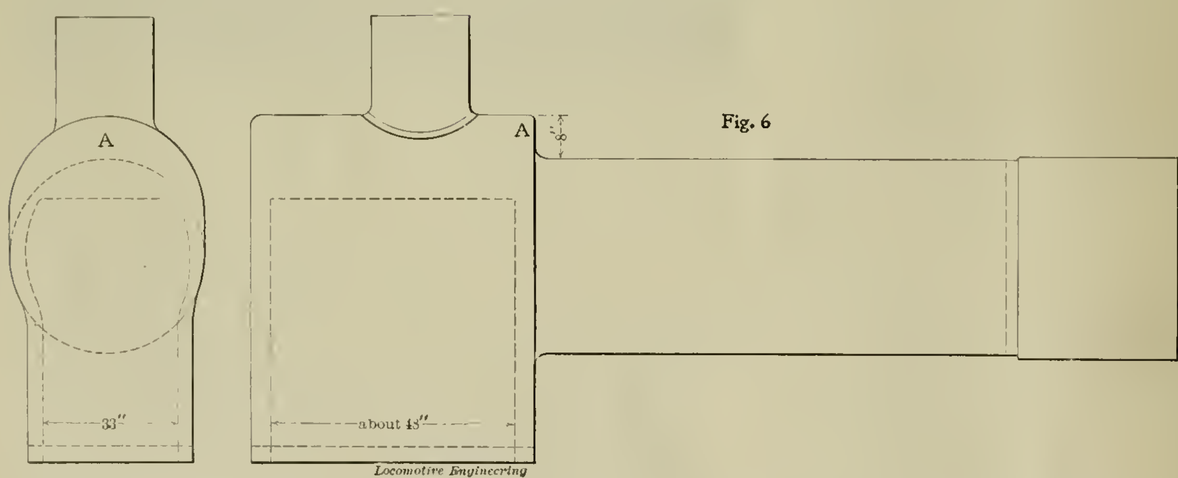
"The joints of the chests and covers were flat, and 1-16-inch sheet copper was used to make the joints. The cylinder heads were made with an air space, as shown in Fig. 5, and polished outside. The core hole at *E* was closed by a brass 'button.'

"The throttle was located in the smokebox, and was a slide valve, operated by a rod inside of the dry pipe, which ran from it to the usual style of lever at the back end of the boiler. The dry pipe made its joint there inside of the stuffing box for the throttle rod (stem). The vertical part of the dry pipe in the dome made its joint on a short "T" in the main pipe, the latter being straight from the back head to the throttle box in the smokebox. The joint of the steam pipe at front flue sheet was flat, and a piece of ⅛-inch sheet copper between flue sheet and throttle box ('crotch pipe'), with a plentiful supply of red lead and about ten bolts through two flanges into the flue sheet, were supposed to make and keep that joint tight (that is, for a time); but, like many other devices, was a source of frequent trouble from leakage until changed.

"The boiler was wagon-top in plan, but without the common sloping connections. Its form was about as in Fig. 6; that is, the connection sheet at *A* was vertical, flanged to suit wagon-top and cylinder part of the boiler, with a 'raise' of about 8 inches. The crown sheet was supported by crown bars. The tubes were of brass, 2 inches diameter and about 11 feet long. The firebox as well as boiler was of course made of iron.

"The dome casing was part brass and part cast iron, and in shape about as shown in Fig. 7. *B* was cast brass, *D*

Fig. 6



sheet brass, and *C C* cast iron, polished. Holes were drilled in at *E* for the escape of steam from the two safety valves, which were of the old style, held down by levers *F* and spring balances *G*, as shown. The whistle projected from the center of this casing *B*, as shown at *H*.

"The sand box corresponded in design to that of the dome, and was about as shown in Fig. 8; was of cast iron, painted, except the cap *I*, which was of brass, polished. The sand pipes were also of brass, ½ inch diameter inside, and were of little use, as the sand would not run through a ½-inch pipe. The bell frame was of the style shown in Fig. 9. The yoke *J* was polished brass; the columns of cast iron, polished. The stem of the bell was round, and taper in the yoke, and held by a bolt *K*, and altogether in plan and finish was quite expensive. The top part was attached to the base at *L*.

"The crossheads were of cast iron, about as per Fig. 10; were offset about 2½ inches. The arm for pump plunger was a part of the crosshead, as at *M*. Guides were of wrought iron, and were not case-hardened. The crossheads, however, had babbitt in slots on the wearing surfaces of the wings.

"The 'pumps' were of cast iron, their upper and lower air chambers polished; glands, cages and valves brass. A part of the pump body-casting made the box for the rockshaft. They were attached to the upper and lower frame bars. (They had both lower and upper air chambers.) The checks were of the usual pattern then used with pumps; pipes were copper.

"The valves were worked by the link motion of a pattern practically the same as in general use to-day; the lifting shaft being located above the eccentric rods the same as at present. The rockshafts were of solid forged wrought iron. Eccentric straps of cast iron of practically the same form as now used, attached to the flat-ended eccentric rods by three bolts.

"The main frames had their pedestal jaws bolted on. Two cast-iron wedges with flanges (both same taper) were used at each driving box; thus protecting the frame from any direct wear of the box, the same as is the practice now. The 'brasses' of driving boxes were of the skeleton type, in two parts, with a brass key *N* between them. The 'skeleton' part *O O* was filled with babbitt metal, as shown in Fig. 11.

"The driving boxes extended upward (had ears) above the frame, as at *P P*, Fig. 12; the spring resting on a roller at *R*.

"The driving wheels had solid spokes, oval in form. The rims were cored, and were 'cut' through at four places, and had wrought-iron filling pieces fitted in the 'cuts.' The hubs were also cored out in the heavy part (into the axle core hole). These wheels were particularly well shaped and neat in appearance. The engine truck wheels had hollow oval spokes; were cored at the middle of the hub and also at the rim (were chilled cast iron, of course). These also were very neat in appearance. The engine truck was of the square frame pattern, having bars 4 x 1¼ inches. They had a spring over each box, held by stirrups. No equalizers were used. The tender trucks were of the same style and pattern as the engine truck; had the same pattern of wheels, spring arrangements, etc., and they also had inside journals the same as the engine truck.

"The tender frame was made of two heavy pieces of timber, about as shown in Fig. 13, at *S S*, with cast-iron brackets *T T*. The end sills were cut to the shape shown at *U U*. These 'inside bearing' tender axles gave much trouble from heating and rapid wear of brasses, especially in dry, dusty weather, and when the wheels were worn out, new trucks were put under with the journals outside of the wheels.

"In design and finish this engine and another of the same pattern and size, except that it had drivers 6 feet in diameter, received a month after the first (named 'William G. Armstrong,' Mr. Armstrong being president of the road at the time), were extremely neat and well finished—more so, probably, than any engines turned out by other builders at that period. Their boilers, in proportion to cylinder area, were nearly or quite up to that of the present day. They steamed well, and were considered unusually 'fast' on a long

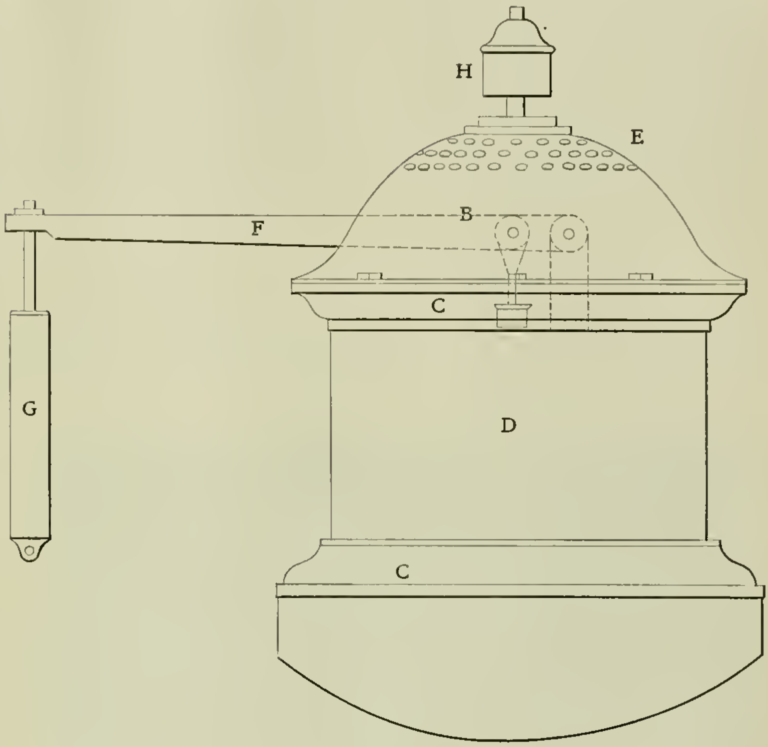


Fig. 7

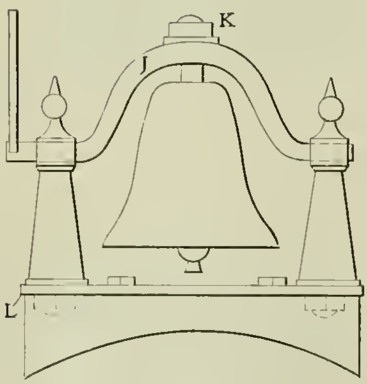


Fig. 9

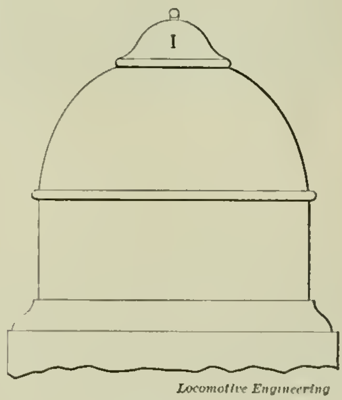


Fig. 8

run; but owing to the comparatively small cylinders and large drivers, they were slow in starting. Their valves had a travel of 4¾ inches at 'full stroke'; had 1-inch outside lap; were 'line and line' inside, and their lead at full stroke was about half the taper of the steam port, shown in Fig. 4; that is, about ⅛ inch at the middle, and a lap of about that much at each end, the edges of the valve being parallel.

"The connecting rods were a straight taper from the 'stub end' at the crosshead to that at the crank pin, slightly flat on each side, where the diameter at the crank-pin end was greater than the 'stub' was wide. These 'flats' ran out to nothing near the middle of the length of the rod.

"The parallel rods were round, and

"These engines were well counterbalanced, the blocks being in pairs, clamping the spokes and rim, and were riveted together. The front wheels also had lead in the rim to give the additional balance for the main connecting rod, and at any speed practicable in those days they were very smooth and easy riding engines—unusually so, in fact. The pilots were of iron slats of about 1 inch diameter round iron, and vertical. They had no blower or oil pipe from cab to steam chest, and to oil the valves the fireman walked on a 4 x 4-inch angle iron from the back end of the cab to the steam chest, carrying the tallow pot. This angle iron was used in place of the modern running board between cab and front end of the engine.

aside from the old bell. The scrap-heap claimed the greater part or nearly the entire engine, and 'had its claim allowed,' and so the first and second engines built by Mr. Mason passed out of existence on the same road that saw them new in their 'pride and prime,' in the autumnal days of 1853.

"These are the recollections I have of the first engine built by Mr. Mason, as I saw it new, used and cared for it during its lifetime of service, and saw the dismantling process in its death, and if anything in the above can serve you a useful purpose, you are welcome to use it.

"Reuben Wells.

"*Paterson, N. J.*"

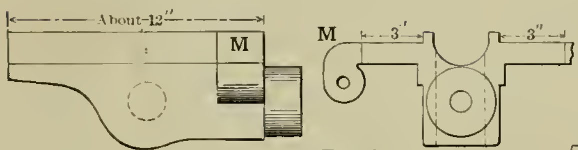


Fig. 10

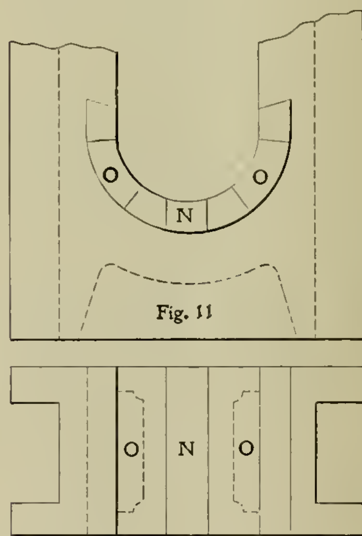


Fig. 11

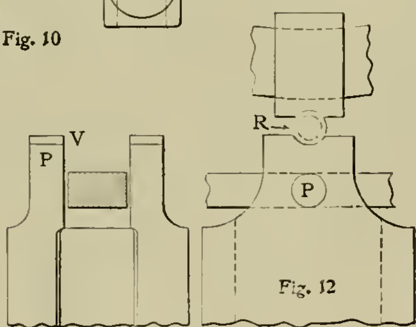


Fig. 12

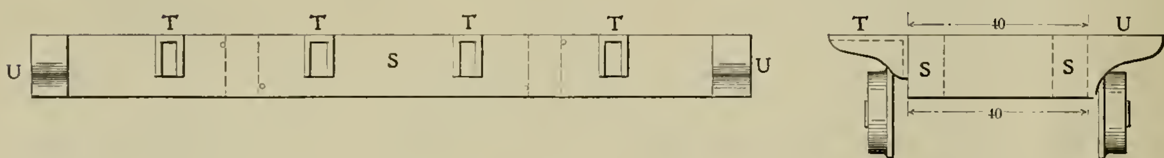


Fig. 13

Locomotive Engineering

about ½ inch larger in the middle than at the stub ends. All, of course, were fitted with straps, bolts and keys. The brasses in the parallel rods projected outward and enclosed the collar on the end of the crank pins. The round body parallel rods gave trouble from frequent breakage, or becoming 'cracked' across the rod not far from its middle, although the metal (iron) in them was of the very finest and toughest quality. The vibrations seemed sooner or later to cause a crack to appear, usually beginning on the upper side, and if not detected in time, breakage was the result; but in case of the main connecting rods mentioned, breakage never occurred, and they lasted the lifetime of the engine.

"Their cabs had sash at sides and in front, but no doors. They were fitted with steam gages ('Ashcrofts'), but these 'early' gages were not reliable, on account of their springs becoming set, or cracking and causing leakage, and other matters that rendered them quite unreliable the greater part of the time; so that the spring balance of the common safety valve had to be depended on mainly.

"The jacket was of Russia iron, with brass bands. Taking these engines altogether, they may, in most respects, be said to have been a little 'ahead of the times' in design, finish and general proportions. They gave good service for about fifteen years and then were rebuilt, leaving little of the original, however,

The bicycle problem is attracting attention "across the pond" just at present, and the *Railway Magazine*, of London, is offering prizes for the best designs "for the proper, safe and economical storage of bicycles in railway brake-vans." The results may possibly give us points as well as our English cousins.

The London & Northwestern Railway people abandoned Joy's valve-gear for a time, but they seem to be returning to it. They have lately applied it to some new powerful tank engines. Mr. Drummond, of the London & South Western, is also using Joy's motion for all his new engines.

Practical Letters from Practical Men.

All letters in this Department must have name of author attached.

Tractive Power of Locomotives.

Editors:

From the way you answered my question 2, page 247, of the May issue, you evidently do not understand my meaning. To make things plain, let us take for example an engine with cylinders 20 x 24, wheels 48 inches, and a M. E. P. of 80 pounds per square inch. The tractive power of this engine would be $20^2 \times 24 \times 80 \div 48 = 16{,}000$ pounds—that is, the power used to pull cars over and above the amount used in propelling the engine. Now let us see what amount of power is exerted in this engine's cylinders. $20^2 \times .7854 = 314.16$ square inches, and in both cylinders twice that amount, or 628.32 square inches; this multiplied by the M. E. P. of 80 pounds equals 50,265.6 pounds, and this amount minus the tractive power leaves 34,265.6 pounds. Now, what I want to know is, what becomes of this power? I claim it is back pressure that must be overcome before the engine will move.

Take this engine when she stands with right main pin on top quarter; the steam presses against the piston and back cylinder head with equal intensity; the pressure on back cylinder head is transmitted to the driving box through the frame, while the piston is pulling the pin forward, and it having the greater leverage (considering the fulcrum at the rail), the wheel is pulled forward. The same thing occurs when the pin is on the bottom quarter, only the back pressure is on the pin, while the forward pull is on the driving box.

I have been considerably laughed at for making the statement that it required about two-thirds of the power exerted in the cylinders to move the engine. I was also laughed at for saying that a small brake shoe would hold as much under the same piston pressure as a large one; also for saying there was just as much strain on the back pedestal jaw when the engine was running ahead as there was on the front one, but I notice these laughers have not proven me wrong as yet. Now, Mr. Editor, will you please explain this thing so we can see who is right and who is wrong?

J. W. Kalfus.

Basalt, Col.

[Our correspondent is mistaken in supposing that there is a margin of power beyond that shown by the traction computation giving 16,000 pounds. The formula which brings these figures is a short method. The calculation made by our correspondent taking the area of the pistons, is the beginning of the full figuring out of the tractive power, which comes out the same as that found by the short method. The problem to be solved is the foot-pounds of work the engine is capable of doing during one revolution of the drivers. To find this, the total pressure on the pistons is multiplied by both strokes in feet, and then the quotient is divided by the circumference of the driving wheels in feet, thus: $50{,}265.6 \times 4 = 201{,}062.4 \div 12.5664 = 16{,}000$.—Ed.]

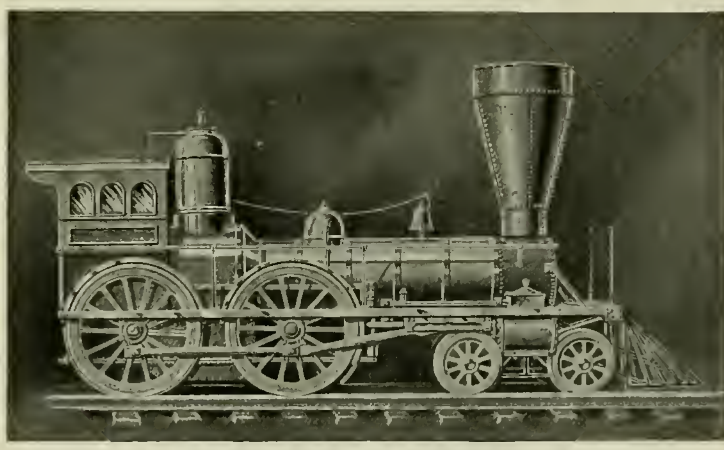
Punishment by Impulse.

Editors:

Reading the article "Railroad in the Confederacy," brought to my mind the first numbers of your valuable paper, when I was asked for an article for your first number; and as I was then in Richmond, Va., as roundhouse foreman, I took that for my text. I am not now in railroad business, yet I have a love for the old paths, and often love to recount the scenes of my railroad experiences.

Sometimes men in authority act very unkindly to those under their hands, and a circumstance illustrating this came under my notice some years ago. An excellent engineer, sober and industrious, was running an express train. The run was West one day, and return the next. One day I received a note from the master mechanic asking what was the condition of engine No. 74 when she went out. I looked over my report and found what had been done, and reported that the engine was in good running order. A report was circulated through the roundhouse, that Bob —— was thirty minutes late at —— and missed the connection, and that he and his fireman were to be laid off for thirty days. I next received a letter from the master mechanic to have No. 74 examined as soon as it arrived next day, and report. At 4.20 P. M. next day it did come, but came about forty minutes late. As soon as engine was in the house Bob reported engine would not make steam. The foreman at the other end of the road had examined the smoke-box, but could find nothing wrong; so I had smoke-box opened, and told him to put on a little steam. All seemed tight—no blow in steam pipes. Now I said, "Reverse her." When he did so, a large jet of steam blew out of exhaust joint on the cylinder. I had the pipes taken out and found that the joint of the right cylinder was 1/8 lower than the left one, and a copper liner had been put in to fill up, as the exhaust pipe covered both cylinders, and one side of the copper joint had been blown out, causing the trouble. I wrote a report to the master mechanic stating what I had found, and that the fault was in the party who built the engine, who should have chipped the high side down instead of putting in the liner and causing honest men to suffer for their failure. I also said in my note to the master mechanic that the report was, that the engineer and fireman were to be laid off for thirty days, which I thought was not right, as they were in no way responsible for the defect of another.

This got me in a little trouble, as very shortly a sharp note came to me from the master mechanic saying he did not



THE JAMES GUTHRIE—FIRST MASON ENGINE.
(For description see page 274.)

thank me for any suggestion as to what he should do; he knew his business, etc. I leave it to any fair-minded man to say whether he was acting on the Golden Rule. But that night when I got home there was a letter calling me to a far better position, and next morning I wrote out my resignation and sent it to the master mechanic's office. Before noon he came to me and said he was sorry to find on his desk my resignation, and if it was on account of that letter he had sent me, he would take it all back, as he did not want me to leave. I told him it was not on account of that, but, as the preachers say, I had a call to a better position, and thanked him for his kindness to me while in his employ.

JNO. J. BINGLEY.

Hanover, Pa.

Reverse Levers.

Editors:

Only too frequently one of the annoyances of the engineer is the rattle and clink of the reverse lever in the cab, coincident with every revolution of the drivers. While it serves as a sort of gage for the consumption of valve oil on the seats and cylinders, calling for an extra squirt when the racket becomes too persistent, the average runner considers it an unmitigated nuisance. The greater the amount of lost motion in the connections the worse is the jingle and clink; but as wear is comparatively rapid in these parts, especially after the first appreciable amount has been worn away, some method should be used which allows of the automatic adjustment of parts, so that the effect of the lost motion shall be eliminated.

Fig. 1 shows the upper end of one form of reverse lever which is in common use. While it has a very tasty and neat appearance, it is an offender in this direction. As can be seen, the spring *C* is connected directly to the latch *B* in such a way that when engaged with the toothed sector or quadrant, as commonly called, the trip or thumb latch *A* is free from any restraining influence but its connections at the pin holes, so that with any lost motion at these points any vibration causes it to rattle, and thus the pins are rapidly worn away even if case-hardened.

On some locomotives built twenty or thirty years ago the form shown in Fig. 2 can be seen. This is not as neat in appearance as the first mentioned case, but it has the great advantage of taking up its own lost motion of parts, so that no matter how badly worn they are—which, for obvious reasons, does not become excessive nearly as quickly as in the previous case, there is a total absence of disagreeable noise; allowing, of course, that the latch fits closely in the notches of the quadrant. This seems to be an instance where utility has been sacrificed to beauty of design.

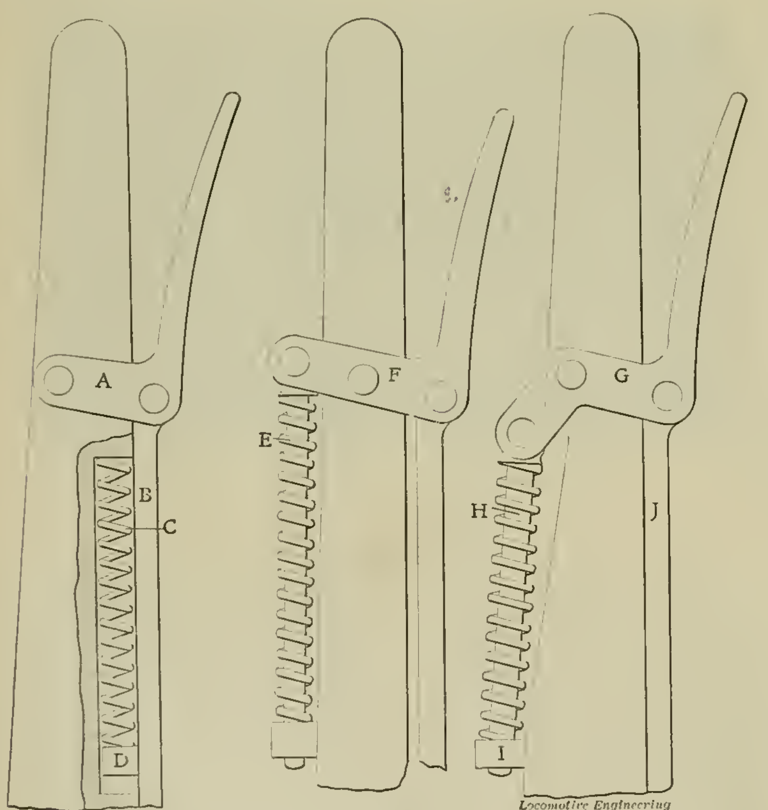


Fig. 1 Fig. 2 Fig. 3

REVERSE LEVERS.

Another point for consideration is the wear of the latch in the quadrant. By far the greater part of this is caused by dragging the latch over the teeth of the quadrant when reversing. While the greater portion of this is caused by carelessness on the part of the engineer, still it often requires considerable effort to prevent it on an engine that does not reverse easily, and also from the fact that the spring resists in a greater degree the more it is compressed, so that greater effort is required to keep the latch at its highest point than to lift it out of the teeth of the quadrant.

Fig. 3 shows a form which, although not particularly handsome, is believed to overcome the faults enumerated in the other. By this arrangement the parts are always under tension, thus doing away with the rattle incident to the lost motion, which is always present in a degree, and also from the application of the toggle-joint principle the resistance offered by the spring grows less instead of greater when the latch is raised; thus the initial pressure of the hand grasping the lever is always sufficient to raise the latch clear of the quadrant. This being the action, the dragging referred to is avoided.

The trip *G* has its back part extended at an angle which carries the spring and spindle *H* rapidly towards the center line of resistance between the lug *I* and the middle pin hole when the latch is raised. The lug *I* has a hole sufficiently large to allow the spindle *H* to rock in passing through it. A considerably stiffer spring is required by this arrangement, as its effective compression is only a fraction of the direct movement of the latch.

FRED E. ROGERS.

Corning, N. Y.

Absurd Power Transmitters

Editors:

On reading your article on page 170 of March issue of LOCOMOTIVE ENGINEERING, describing a recently patented chainless bicycle driven by electricity, my curiosity was aroused to ask how much worse is it than Heilmann's self-contained electric locomotive, illustrated by you in September issue of last year, and is either very much more unreasonable than to belt a huge steam engine to a dynamo, run a wire the full length of the road, and, by means of a fishing-pole apparatus, transmit the energy to a motor on a car, which in turn drives the wheels, which, we are told by our friends, will be the most approved means of transcontinental travel within a short time. All three are absurd and deserve a place alongside Gilderfluke and Holman.

As to what a locomotive is, Webster says a locomotive is a steam engine placed on wheels for drawing cars on railways, and I guess he is about right. Let her mote.

J. H. Huntley.

Kingsburg, Cal.

Stresses on Pedestal Jaws.

Editors:

Permit me to differ with your answer to the first question of J. W. K., Basalt, Col. (No. 41, of May, 1898, page 247). He asks: "When an engine is running ahead and pulling a train, where is the most strain, on the front or back pedestal jaw, or is it equal?" You reply that, "The strains on the front and back of the jaw are equal, etc." (By the way, should you not have said "stresses"?)

By an inspection of the following diagrams, you will note the points of my proof:

Suppose an engine having 18 x 24-inch cylinders, 72-inch drivers and carrying 175 pounds of steam. The engine is, by hypothesis, pulling a train, and we will further suppose that it is running slowly, so as to be in full gear. Then the maximum pressure on the pedestal jaws will be approximately when the crank pins are on the upper and lower quarters. The area of an 18-inch diameter piston (neglecting the rod) is about 254 square inches. With 175 pounds boiler pressure we may realize 140 pounds on the piston. Multiplying 254 by 140 gives 35,560 pounds, the thrust on the piston rod. Consider now this as a force, applied in a line parallel to the track to the crank pin on the top quarter.

If the center of the crank pin and the point of contact of the wheel with the rail be considered the extremities of a lever *A C* 4 feet long, the fulcrum is at the rail *C*; the application of the force to the pedestal jaw is at the axle *B*, 1 foot from the crank pin *A*, and the lever is one in the second order. The lever arms are here 3 to 4. Consider the forces in equilibrium and we have a stress of 35,560 pounds acting at the crank-pin end, 1 foot from the axle, or 4 feet from *C*. Multiplying 35,560 by 4, the length of the lever arm *A C* in feet, and dividing by 3, the length of the other lever arm *B C*, we obtain 47,413 as the number of pounds exerted at the axle against the front pedestal jaw.

The difference of these two forms, or 11,853 pounds, gives the force acting at the end of the lever, which in this case is resisted by the friction between the wheel and rail.

Consider now the fact that not only is the steam pushing the piston forward in the cylinder, but that it is also pushing on the back cylinder head with a force of 35,560 pounds. This is transferred by the frames, and as it is in an opposite direction to the force pushing forward on the front pedestal jaw, the difference of these two, or 11,853 pounds, must be taken as the net pull transferred to the draw-bar.

Let us now proceed to the other position, with the crank on the lower quarter. Here we have a lever *B C*, 3 feet long, one of whose ends *B* is the center of the axle, and the other the point of contact of the wheel with the rail *C*. The fulcrum is at the latter point as before, but the lever is now one of the third order.

With a force of 35,560 pounds on the crank pin *A*, as before, one-third of this will go to the rail and two-thirds to the axle, the forces being divided inversely proportionately to the respective lengths of the lever arms. This gives 11,853 pounds at the rail as before, and 23,707 pounds against the back pedestal jaw. Remember now, however, that the steam is also pushing against the front cylinder head with a force of 35,560 pounds, and this is transferred by the frames as before, so that the difference of these two amounts, or 11,853 pounds, is the net effort applied to the draw-bar.

We therefore see that the stresses are double as much on the front pedestal jaw as they are on the back one.

William Elmer, Jr.

Altoona, Pa.

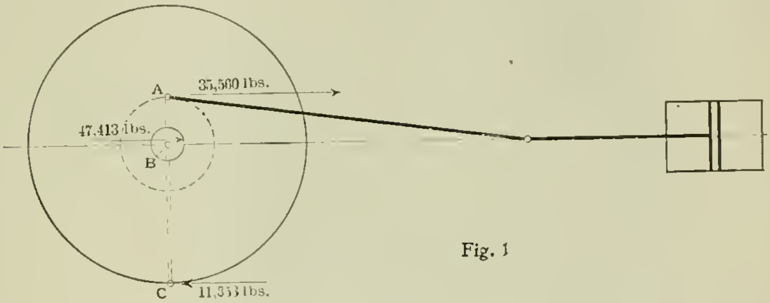


Fig. 1

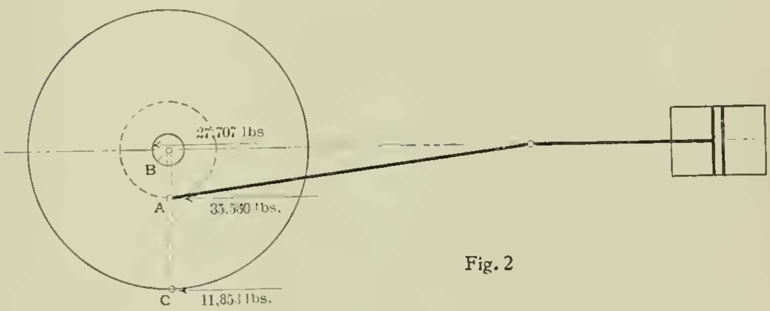


Fig. 2

STRESSES ON PEDESTAL JAWS.

A New Staybolt Scheme.

Editors:

Reading your editorial in the May number about staybolts brings up the following: I see that in some of the specifications for boilers, with firebox steel of 7-16 to ½ inch thickness, staybolts as large as 1⅛ inches are specified, and the thought comes to my mind, is it possible for any bending to take place where so large a bolt is secured to so thin a sheet? and if so, or in any case if this bending action takes place (as I know is universally believed, and staybolts reduced between the threads to favor that action), the following scheme has occurred to me as one possible and far more effective than the one now followed:

We all understand that four rods ½ inch square will stand in tension as much as one 1 inch square and bend four times as far, or spring the same distance a great many more times, without rupture, and hence the idea of making staybolts in one of the two following methods presents itself:

After the staybolt is otherwise finished, it could be split in four parts by a thin saw in a milling machine, and afterwards galvanized or tinned to prevent rusting, or the bolt made of iron first drawn in the form of a quarter of a circle, then four pieces of the proper length kinked so as to fit only at the ends, welded and rounded to size with the square for screwing in forged on. After this the center brought to a forging heat and reduced to below the bottom of the thread by a Bradley hammer.

This, one would think, ought to leave the bolt of full strength and quite flexible.

Of course the objection will at once be raised, the extra cost; but then, compared to the entire cost of a locomotive, it would not be great, and if there is any machine where any amount of cost will make it better is justifiable, it would seem to be the locomotive.

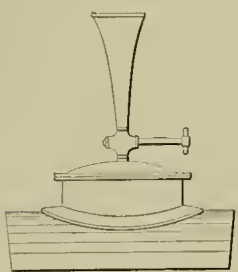
JOHN E. SWEET.

Syracuse, N. Y.

The Invention of the Steam Whistle.

Editors:

With reference to the remarks on page 190 of your April issue, the first steam whistle was not used upon the Liverpool & Manchester Railway. The first engine in the world to have any means of calling attention by means of steam was the "Samson," upon the Leicester & Swannington Railway (and I enclose the details). The whole of the particulars are copied from the books of the railway company and the diagram is a copy of the official one. The name of the driver was Robert Weatherburn, and the point of collision was at the "Stag and Castle" Inn, 9¾ miles from Leicester. The driver's report states that "he used the



Locomotive Engineering

horn, lifted the safety valves and opened the cylinder taps, but could not call attention, and the left-hand buffer of the engine 'Samson' caught the back corner of the cart."

CLEMENT E. STRETTON, C. E.

Saxe-Coburg House, Leicester, England, April 27, 1898.

The following is the quotation referred to by Mr. Stretton:

"One of the first events in the history of the 'Samson' was that it ran into a horse and cart crossing the line at Thornton, the cart being loaded with butter and eggs for the Leicester market. The engine driver had but the usual 'horn,' and could not attract attention. Mr. Ashlen Bagster, the manager of the railway, went the same day to Alton Grange to report the circumstance to Mr. George Stephenson, who was one of the directors and the largest shareholder. After various ideas had been considered, Mr. Bagster remarked: 'Is it not possible to have a whistle fitted on the engine which steam can blow?' George Stephenson replied: 'A very good thought; go and have one made,' and such an appliance was at once constructed by a local musical instrument maker in Leicester. It was put on in ten days, and tried in the presence of the Board of Directors, who ordered other trumpets to be made for the other engines which the company possessed. The following illustration is a copy of the official drawing.

"The accident at Thornton was therefore the origin of the steam whistle, and the bell whistle, as we now have it, is an improvement upon the trumpet."

[The account giving the history of the invention of the steam whistle, published in the April number of LOCOMOTIVE ENGINEERING, was taken from Colburn's *Locomotive Engineering*, which was written prior to 1870. A great many of the pioneers in locomotive designing were then alive, and it is not likely that Colburn made positive statements about the invention of the steam whistle, without having been certain of his facts. The time for that invention came with the advent of fast trains, and it is not unlikely that a steam trumpet, or crude noise-maker, was invented almost simultaneously by different men. But reliable history says that the cup or bell whistle was the invention of William Stephens, of Dowlais Iron Works, Wales, and that it awoke the echoes of the Welsh mountains as early as 1830, three years prior to the egg-breaking incident. Bury's people, locomotive builders, in England, were the first to apply the real steam whistle to a locomotive. —Ed.]

With Both Cylinder Heads Broken.

Editors:

In answer to question 29 in last month's issue, you say an engine cannot run with both front cylinder heads gone and front ports blocked. I can see no reason why this cannot be accomplished, and if I am ever so unfortunate as to break both front heads I shall certainly put it to the test. You say this is a puzzle question. If it is, I fail to see where the catch comes in, and I think it is a point that would be well for engineers and firemen to study on. In speaking of front cylinder heads, I mean the ones next to pilot, and not the ones next to crosshead, which might in some cases be regarded as the front ones, and presume you mean the same. Of course, in starting an engine in this condition, it would be necessary to have her in a certain position, say with right pin on upper back eight; she would then have use of steam until said pin was about the bottom quarter, when the left exhaust would take place, and it would be necessary for her to travel only a little over a quarter of a revolution until she took steam on right side again; and I think, by using a little sand and plenty of throttle, this could be easily accomplished on level track, or perhaps a 1 per cent. grade. While I have never seen an engine coming in in this condition, I will always believe it can be done, until it is proven otherwise. If you can prove it, please do so.

J. W. KALFUS.

Basalt, Colo.

Leanings Towards Wasteful Practices.

Editors:

Quite a controversy seems to be going on just now on the subject of saving oil at the expense of coal; also on "Wide-open Throttle" and "Short Cut-off," vs. "Wire-drawn Steam" and "Down in the Corner." I fail to see any argument on the part of the opponents of oil saving or wide-open throttle. They do not seem to know that "enough and no waste is as good as a feast." They seem to harp on the string of using too little oil, or of the evil of using a wide-open throttle, and thereby running the engine too fast. No railroad official wants his engineers to use too little oil, or to run ahead of time for the sake of using throttle "wide open." It goes without saying that in the past an immense waste in oil—in fact, all engine supplies—was the rule. To the writer's personal knowledge, on a road where he ran an engine, there was a range of from 3 quarts to 12 quarts of oil on same class of engines doing same work and mileage. Someone surely wasted 9 quarts of oil per trip of 100 miles. Singular to say, one of the 3-quart engines burned 25 per cent. less fuel than the "12-quart-ers." What would be thought, to-day, of an engine with 15½ x 20-inch cylinders using 3 quarts of A No. 1 sperm oil on machinery and 4 pounds of tallow in cylinders per 100 miles?

If you have hooked up your lever as far as will do the work, and a wide-open throttle is too much, close it, until you find the steam supply harmonizes with the cut-off.

The world is full of fault-finders. An "old experienced engineer" who had been handed an order not to run faster in a fog than would allow him to stop his train in the distance he could see, blurted out, "No man can run a train that way."

In 1850 I examined the cylinder and piston packing of a 45 horse-power stationary engine in the Phoenix Iron Company's rolling mill at Phoenixville, Pa., that had been running over one year (I think two) without a drop of any kind of lubricant having been used in cylinder. Cylinder and packing were without a scratch. The packing ring was of cast iron, of a design gotten up by Mr. Wm. Turner, the first engineer of the plant.

E. J. RAUCH.

New York.

The Buffalo Forge Company have supplied to the government a great many engines and fans to be used in the navy for reducing forced draft in the engine rooms. A number of these fans were ordered at one time, and the works were run night and day, so that the order was completed in four days. Nearly all vessels belonging to the navy are now supplied with appliances for producing forced draft in the stoke-hold, which greatly increases the steam-making capacity of the boiler.

Wisconsin Central Ten-Wheelers.

The Wisconsin Central lines have had in service for a short time some new Brooks ten-wheeled passenger and freight engines which have already made a record for exceptionally fine work. These engines were designed for heavy traffic in their respective lines, and are exact duplicates in all details except diameter of cylinders and driving wheels. The passenger engines, herewith illustrated, have 19 x 26-inch cylinders and 69-inch drivers, while the freight engines have 20 x 26-inch cylinders and 63-inch drivers.

There are many unusual points in design on these engines that will engage the attention of locomotive men, and prominent among these are the piston valves with internal admission, having 1⅛-inch lap, 1-16-inch negative lead, ⅛ inch clearance, and 7 inches total travel. The rocker has both arms on the inner end of the shaft, and the valve rod is offset in order to clear the top of the spring at the forward drivers. The link motion has a central suspension by means of one arm on the reverse shaft; the link hangers being pivoted to either side of the arm at the center. This construction is an improvement over the shaft with two arms.

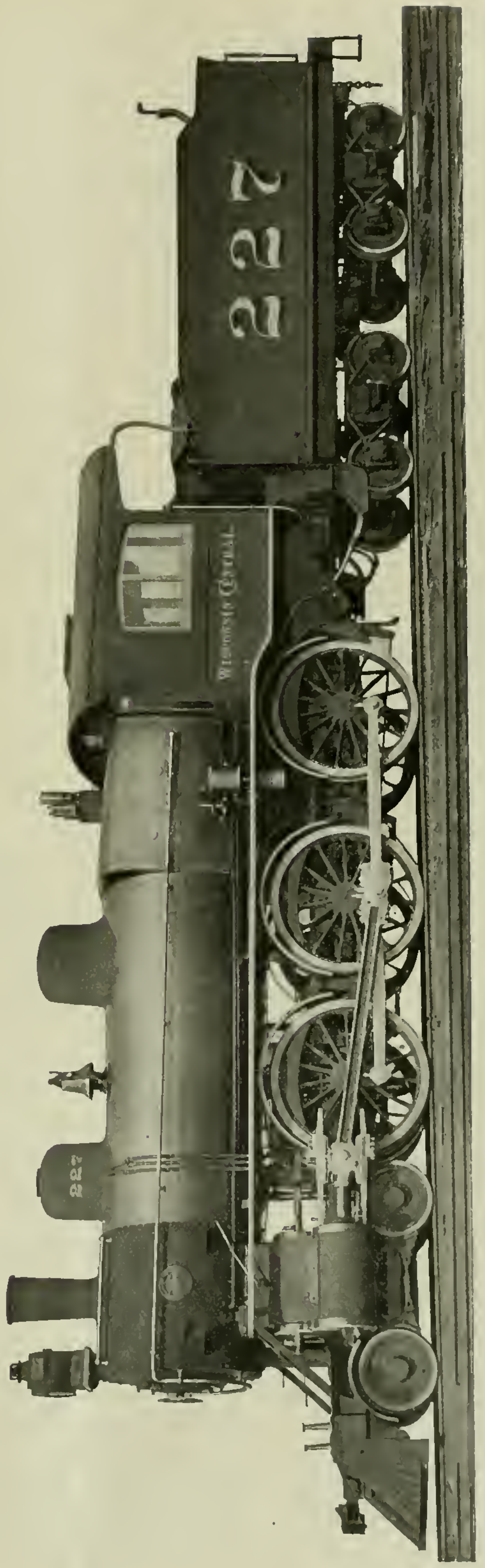
The spring arrangement is a novelty in present day practice, since the load on the front drivers is sustained by a half elliptic spring extending across the engine and resting on the saddles over the forward boxes, and does not equalize with any other wheels. The main and rear wheels equalize with each other through double elliptic springs at the outer ends of the equalizers which rest on the tops of boxes, and all below the top of frame, making one of the smoothest riding engines we were ever on.

The braking system takes in all wheels on the passenger engines, and all wheels except engine truck on the freight engines. Driver brake shoes are applied at the rear of the wheels instead of at the front. A marked departure in the location of driver brake cylinders has been introduced in these engines, they being located between the frames, side by side, just back of the front axles.

The two injectors discharge into their checks which are contained in one common case, located on top of the roof of boiler inside of the cab. The delivery is not on the crown sheet, however, there being a three-inch pipe connected to the checks, which conveys the water to a point about midway between the flue-sheets.

In frame construction there are also some new points, notably in the slab style at front and back. The forward section from its junction with the main frame and at the point of cylinder connection, is 3 inches thick and 10 inches deep, while at the back end the main frame is reduced to 1½ inches thick by 10 inches deep at the smallest place.

The engraving of piston valve shows a



BROOKS PASSENGER TEN-WHEELER FOR WISCONSIN CENTRAL.

different style of ring than is used in the engines. A large view of the rings adopted is shown with their dowel fastenings, and also a view of the manner of cutting the rings is shown in separate detail in the illustration. The valve stems extend through the steam chest at the front, and are carried in a guide lined with white metal, and outside of which is a gland. A careful study of the engravings will show the machines to be the latest development of a high-class locomotive, of the performance of which Superintendent of Motive Power McNaughton has reason to be gratified. Below will be found comparative dimensions of these engines:

DESCRIPTION.

Weight on drivers—116,000 pounds; 115,000 pounds.

Weight on trucks—34,000 pounds.

Weight, total—150,000 pounds; 149,000 pounds.

Weight tender, average—75,000 pounds.

Weight tender, loaded, maximum—94,000 pounds.

Wheel-base, total, of engine, 24 feet 9 inches.

Wheel-base, driving—14 feet 6 inches.

Wheel-base, total (engine and tender)—52 feet 2 inches.

Length over all, engine—38 feet 2 inches.

Length over all, total (engine and tender)—62 feet 6 inches.

Hight center of boiler above rails—8 feet 11 inches; 8 feet 8 inches.

Hight of stack above rails—14 feet 11½ inches, 14 feet 8½ inches.

Heating surface, firebox and arch pipes—189 square feet.

Heating surface, tubes—2,111 square feet.

Heating surface, total—2,300 square feet.

Grate area—32.4 square feet.

Drivers, number—Six.

Drivers, diameter—69 inches; 63 inches.

Drivers, material of centers—Cast steel.

Truck wheels, diameter—33 inches.

Journals, driving axle, main—9 x 11 inches.

Journals, driving axle, front and back—8½ x 11 inches.

Journals, truck—5½ x 12 inches.

Main crank pin, size—6¼ x 6 inches.

Cylinders, diameter—19 inches; 20 inches.

Piston, stroke—26 inches.

Piston rod, diameter—4 inches.

Kind of piston rod packing—Jerome.

Main rod, length center to center—119 inches.

Steam ports, length—18 inches.

Steam ports, area—36 square inches.

Steam ports, width—2 inches.

Exhaust ports, length—56 inches.

Exhaust ports, least area—66.5 sq. in.

Bridge, width—2½ inches.

Valves, kind of—Improved piston with internal admission.

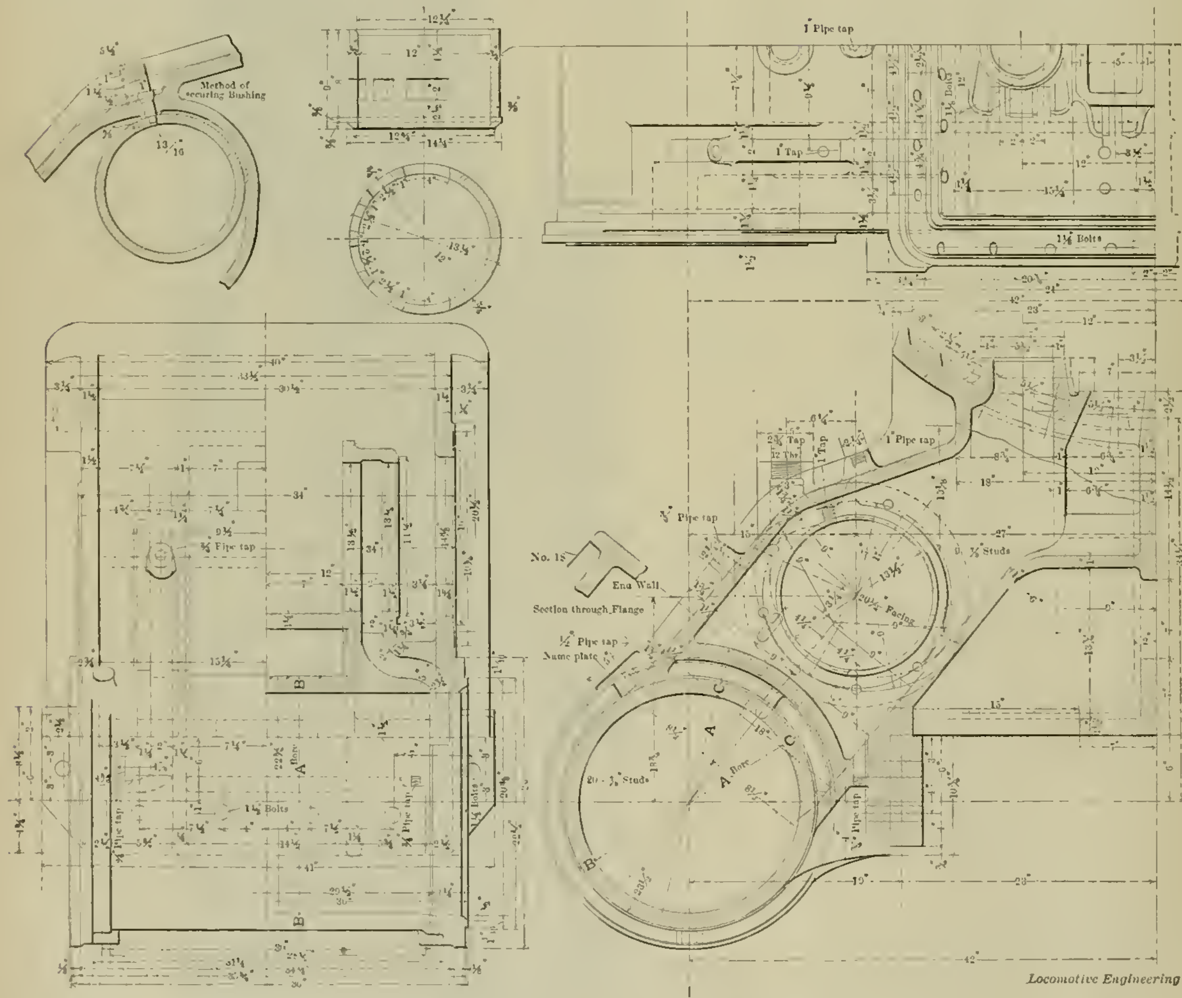
Valves, greatest travel—7 inches.

Valves, steam lap (inside)—1⅛ inches.

Valves, exhaust lap or clearance (outside)—⅛ inch clearance.

Lead in full gear—1-16; 0.

Boiler, type of—Belpaire conical connection, with wagon top.



CYLINDERS OF BROOKS WISCONSIN CENTRAL ENGINE.

Boiler, working steam pressure—200 pounds.

Boiler, material in barrel—Steel.

Boiler, thickness of material in barrel—⅝ inch.

Boiler, thickness of tube sheet—¾ inch.

Boiler, diameter of barrel—66 inches.

Seams, kind of horizontal—Quintuple.

Seams, kind of circumferential—Double.

Crown sheet stayed with—Radial stays.

Dome, diameter—30 inches.

Firebox, type—Sloping, over frames.

Firebox, length—113 inches.

Firebox, width—41⅜ inches.

Firebox, depth, front—78 inches.

Firebox, depth, back—60 inches.

Firebox, material—Steel.

Firebox, thickness of sheets—Side, 5-16 inch; crown and back, ⅜ inch; tube, ⅝ inch.

Firebox, brick arch—On water tubes.

Firebox, mud ring, width—Back, 3½ inches; sides, 3½ inches; front, 4 inches.

Firebox, water space at top—Back, 4½ inches; sides, 5 inches; front, 4 inches.

Tubes, number of—308.

Tubes, material—Charcoal iron.

Tubes, outside diameter—2 inches.

Tubes, thickness—No. 12, B. W. G.

Tubes, length over tube sheets—13 feet 2¼ inches.

Smokebox, diameter outside—69 inches.

Smokebox, length from flue-sheet—63 inches.

Exhaust nozzle, single or double—Single.

Exhaust nozzle, diameter—4⅞, 5, 5⅛ inches.

Stack, least diameter—15⅞ inches.

Stack, greatest diameter, 18⅞ inches.

Stack, hight above smokebox—38 inches.

SPECIAL EQUIPMENT.

Brakes—Westinghouse American for engine, tender and train service.

Pump—9½-inch Westinghouse.

Bell-ringer—Golmar.

Sight-feed lubricators—Michigan; Nathan.

Safety valves—Crosby.

Injectors—Hancock No. 8, Monitor No. 9 and Metropolitan No. 8.

Springs—A. French Spring Co.

Metallic packing—Jerome.

Blow-off cock—McIntosh.

Tires—Krupp.

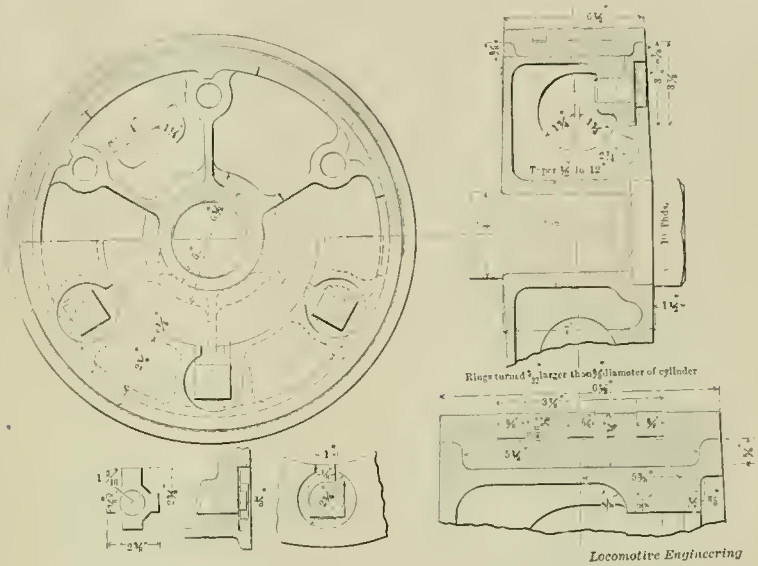
Harmony in Railroad Service.

"It is a mistake to suppose that the success of any of man's undertakings is dependent upon chance," said Mr. A. G. Grant in a paper read before the Texas Railroad Club, "or that the tide of their progress is fostered by any other than their own inherent strength." Then he proceeded to dilate upon the advantages and benefits of harmony in railroad service. A strong plea was made for the selection of men for merit and fitness instead of the favoritism due to common political, religious, fraternal or social influences. The demoralizing effect of selecting men who were not adapted by ability or training for the work to be done was strongly emphasized.

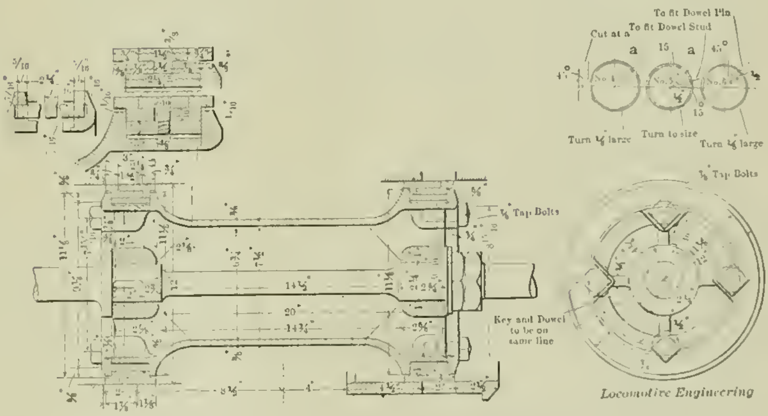
"The general manager," continued Mr. Grant, " is the man at the helm, who must organize and set into operation this vast machine. His will must give direction, scope and bounds to each department. His genius must pervade the entire organization, stamping itself upon every detail of the work. From the general manager should come a policy so thorough, plain and unequivocal that no man need hesitate in determining his course or making bounds and limits of his authority. Such a policy should bear the imprint of the strictest justice to all and should show due appreciation for competent and faithful service.

"The top round of the ladder is the place to begin this reform, as it is from this source that the inspiration is most readily disseminated and thoroughly imbibed. The management of railways has long since passed the experimental stage and has now become a science. Success is therefore largely dependent upon the scope of knowledge and energy with which their affairs are administered. The up-to-date manager studies his business as he would study the practice of the most learned profession. He knows his men as a commander knows his soldiers. He knows the length, breadth and depth of their respective abilities and to what extent each can be trusted. He carefully studies their every nature, their faults, their shortcomings, their vices and their virtues. With skill and judgment each man is selected for the position best suited to his attainments, with due regard to a perfect harmonious working together of all the departments. He knows the cat and dog cannot be tied together without disastrous consequences. He well knows the ruinous effect of discord and wrangling in the ranks he controls, and likewise he knows the remedy.

"When it comes to pass that men are



PISTON OF BROOKS WISCONSIN CENTRAL ENGINE.



PISTON VALVE OF BROOKS WISCONSIN CENTRAL ENGINE.

selected for and retained in the various branches of railway service upon cold-blooded business principles with respect to their honesty and qualifications, with every other consideration thrown to the winds, discord will be unknown. Harmony will prevail, and the company will find their business better managed, and better returns for salaries paid."

Acute Convention Canvassers.

The people who attend the Locomotive Engineers' Convention could give points to all others in canvassing for the next place of meeting. The convention at St. Louis had scarcely opened, when there were canvassers working for three or four different places. They had buttons giving the name of the place advocated. The advocates of Saratoga brought a large quantity of Saratoga mineral water, which was given to indicate one attraction of that place. We are a little doubtful of that means of help, for we heard several delegates regretting that they had imbibed so freely of that water, and we learned that "taking something to counteract the effects of that water" was given to wives as an excuse for inability to find the key-hole of the room door.

The advocates of Milwaukee, who seemed to be the most enterprising, threatened to offset the Saratoga water with an unlimited supply of Milwaukee beer. We did not learn that this threat was carried out, but we heard that it sent consternation into the Saratoga camp.

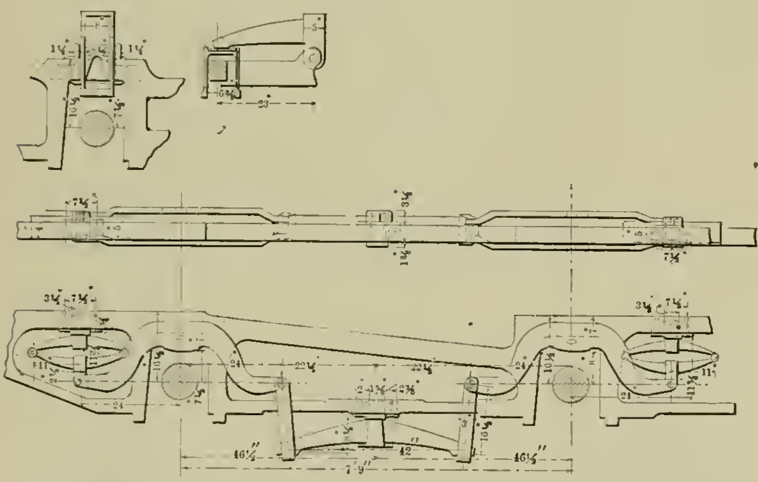
We trust that the victors will be considerate. Be it water or beer two years hence, we trust that the beverage will be drunk with moderation.

Improvement on the Brown System.

Receiver Felton, of the Queen & Crescent, has introduced an important improvement on the Brown system of discipline without suspension, which is in operation on the Cincinnati, New Orleans & Texas Pacific System. Mr. Felton recognized the fact that there ought to be some financial reward for real worth, and for the half year ending December 31st last paid premiums of $40 each to eleven freight conductors, and for the nine months ending on the same day premiums were paid to twenty station agents and fourteen telegraph operators. The agents received $15 each, except in cases where they were not telegraph operators, in which case they received $10, and men who were only operators received $5 each. Two agents received each $15 additional for showing the largest percentage of increase in sales of tickets, collections of extra baggage, etc., and the total amount of all these premiums was $820.

Freight conductors make their record on six features of their work: (1) cars moved; (2) making schedule time; (3) promptness and accuracy in reports; (4) cleanliness; (5) economical use of supplies; (6) good judgment in emergencies. The conductor moving the largest number of cars in a month is credited with 300 "merits," and the other conductors receive credits in a reasonable proportion to this. A perfect record is indicated by 10 merits in each feature for each day. A conductor running his train through in not less than two hours greater than the time allowed is marked 10 in that column.

For exercising good judgment in emergencies merits may be awarded from 10 to 600. For breaches of rules or accidents demerits are imposed, and the total of these is deducted from the merits before the average is taken. If a conductor is held responsible for an accident resulting in $50 damages, he would receive 50 demerits; $100 damage, 100 demerits. The average is obtained by dividing the net total of merits by the total number of trains.



SPRING ARRANGEMENT OF BROOKS WISCONSIN CENTRAL TEN-WHEELER.

The railways in Japan are now almost entirely operated by native workmen, and they are reported to display a decided capacity for railroad work. There is a belief in the Western World that the Orientals have no minds of their own about maintaining their rights or privileges, but a hint to the contrary has lately been given by the enginemen of the Nippon Railway, one of the largest in Japan, going out on strike. We cannot make out from reports received what the grievances were, for they were not on account of the pay being unsatisfactory, and nothing was said about superintendent's discharging men because he was suffering from bile—the two leading causes for strikes of railroad men in Christian countries—but be the grievances what they may, they were remedied after the railroad had been tied up for five days.

Steel Tubes for the Navy.

The Shelby Steel Tube Company, which have recently acquired the interests of a number of the largest seamless tube mills both in Pennsylvania and Ohio have recently secured a large contract from the United States Navy Department for boiler tubes. These tubes are of seamless cold-drawn steel, 2¼ inches in diameter by 9 gage. All of the tubes are upset on one end. It is understood that this order comprises a full set of tubes for all of the boilers for the battleships Iowa, Brooklyn, Cincinnati, Bennington, and a partial set for the Texas. These tubes are all to be delivered within sixty days. The Shelby Steel Tube Company are thoroughly equipped for doing this class of work.

This contract is of general interest, inasmuch as it is the first time of late years where the United States Navy have taken the steel tube in preference to the lap-welded charcoal iron tube that they have heretofore been using. The specifications governing the purchase of tubes for marine boilers of standard Scotch type have been amended so as to admit of the use of seamless cold-drawn steel tubing in competition with the lap-welded charcoal iron tubes.

We believe that Shandy Maguire's latest poem is the best that he has written. It is an address to His Holiness Pope Leo XIII. requesting him to ignore the petition of the Queen of Spain asking for the prayers of the Holy Father for the success of the Spanish cause. Shandy feels about Spain as the hunter did about the grizzly bear that he was preparing to tackle. The hunter's prayer was, "O Lord, help me if you see fit, but if you don't help me don't help the grizzly, and you will see the hottest fight you have ever witnessed in Kentucky." That is all Shandy wants with Spain, and he has abiding faith in how the fight will end.

Railroads and the War.

Although many of the railroad men are doubtless chafing because of not seeing "active service" in assisting the work of our army and navy as do their brother mechanics in the gun factory, they should remember that they, too, have an important work to perform. Even the humble coal train, with its grimy load, is a necessity for the furtherance of Uncle Sam's plans, and a wreck, or other delay to the coal supply, might have a disastrous effect on the result of a battle at sea, owing to lack of coal, which was delayed in transit.

When it comes to hauling provisions or other supplies, as well as the soldiers who are to do the actual fighting, no one can doubt the importance of this work and the effect of its being safely and speedily done. All cannot be fighters, for the many must be workers to keep the wheels of industry moving and to make and carry the necessary supplies to those at the front.

That the railroad men do not lack enthusiasm, patriotism or bravery, no one can doubt for a minute. At the various roundhouses and yards "Old Glory" flies in all sizes and positions. The Lehigh Valley men recently raised a 20 x 30-foot flag at Jersey City, and their enthusiasm is larger than the flag.

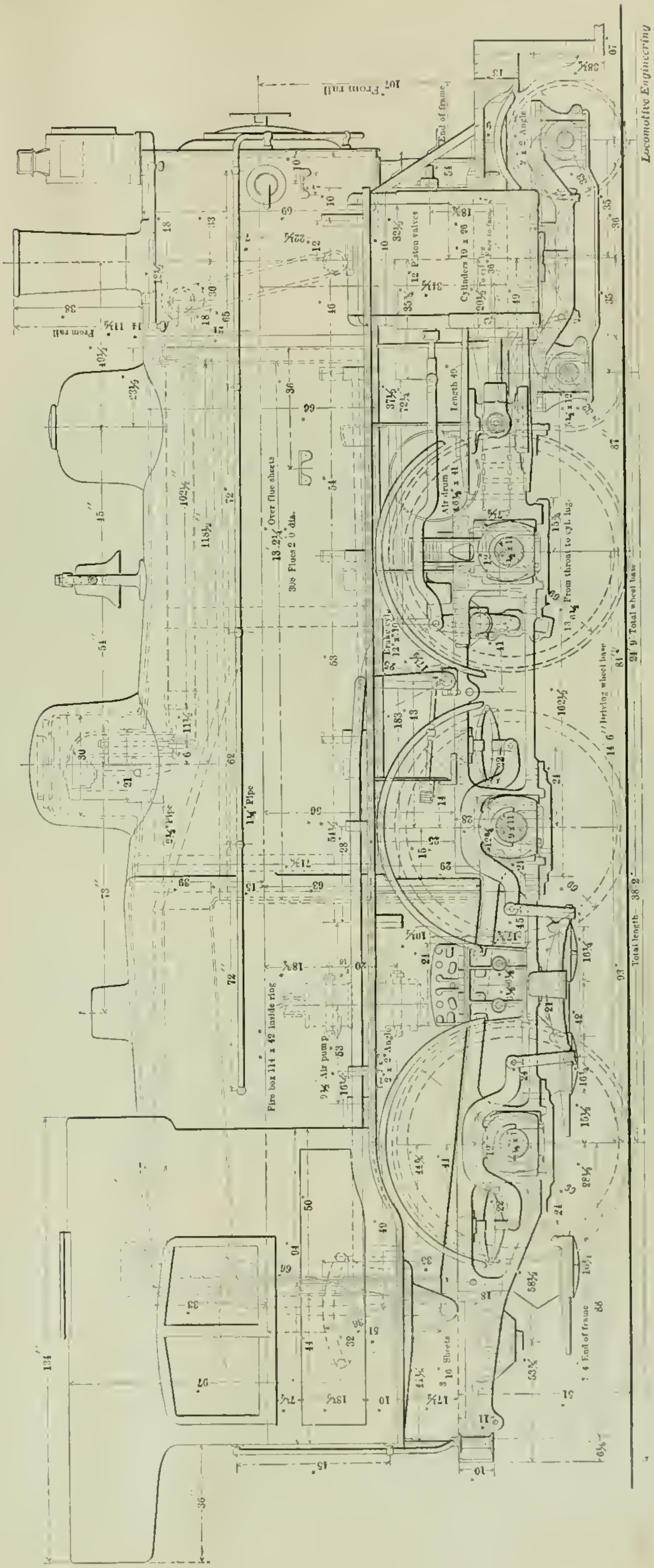
The different roads are making extensive preparations for handling troops expeditiously and comfortably, and if the men suffer any inconvenience, they can console themselves by thinking of how much worse it was in the days of the rebellion. Now many of the roads are using tourist cars and trying to make life bearable while in transit.

The New York Central handled 2,500 men at twenty-four hours' notice recently; while in the South and in the vicinity of Chickamauga the Southern Road and the Plant System are daily handling large numbers of troops. The Pennsylvania took a train of nine sections, containing New York and Massachusetts troops, at short notice.

We trust the necessity for this may not be long continued, but the promptness with which the roads meet the requirements shows a complete grasp of details and the capability of meeting an emergency.

Valve Chart Given Away.

The Lunkenheimer Company, of Cincinnati, O., are issuing, for the use of engineers, a simple and practical chart giving diagrams of a new method of analyzing the movement of the slide valve. Every engineer should have one, as its use will enable him to thoroughly understand the relation between the slide valve and crank movements without the aid of any intricate mathematical calculations whatever. Sent free upon request of any bona fide engineer.



BROOKS WISCONSIN CENTRAL TEN-WHEELER.

Model Railway Showing Safety Appliances.

Our illustrations show a model track and its rolling stock, to be seen at Sherburne, N. Y., a town on the Utica division of the Delaware, Lackawanna & Western Railway. It has been built to illustrate the variety of safety appliances designed by Messrs. Lyman & Sherwood. The locomotive is a model of a Delaware, Lackawanna & Western culm burner, and is operated by compressed air. Around the track are a variety of automatic signalling appliances, among them being station signals, highway crossing alarms and devices for operating highway crossings. The Highway Crossing Signal Bell, to warn pedestrians and travelers generally of approaching trains, as invented by Mr. Sherwood, has been in successful operation near the station at Sherburne for the last sixteen months, on the D., L. & W. R. R. It works perfectly, and it is difficult to see how it can possibly be improved. The extremes of weather have no ill effects, for it has been subjected to intense heat and cold, and has continued doing its duty without a stoppage. That this appliance is practical and of the greatest value as a positive safeguard cannot be questioned by anyone who has looked it over and watched its operation. The actual demonstration that has been going on at Sherburne with the above device proves conclusively that the inventors have succeeded far beyond the expectations of the most sanguine.

CIRCULAR TRACK AND EQUIPMENT.

WAITING FOR ORDERS.

Secured Right of Way by Dancing.

In 1895 the Gila Valley, Globe & Northern Railway Company obtained from Washington the franchise for a road through the reservation, subject to the approval of the Indians. This proposed line is to run from Geronimo to Globe, a distance of 60 miles, and is to be practically an extension of the 65 miles of road that connect Geronimo with the Southern Pacific station at Bowie.

A large area of mineral and coal land is to be opened up by the new line. Since Congress granted the conditional franchise agents have been at work among the Indians, but arbitrary refusal was given until the general council was called at San Carlos. Fully 1,500 Apaches were present, and the entertainment of them was the first item of cost in the railroad construction account. A feast and council was proposed, and invitations were sent by means of runners to all parts of the Indian domain.

There were Indians who had burned, slain and tortured just out of natural depravity dancing about on the same floor with capitalists from Chicago and San Francisco, soldiers, ladies, frontiersmen, miners and a couple of globe trotters. Everyone had to dance. The etiquette was explained to all, and it was made evident that if they chose to be present and take part they must observe all the demands of the occasion, for a refusal might imperil the lives of all. The dance was accordingly very democratic. Whoever the Indians asked to dance with them responded with a smiling assent.

On the following day a solemn conference was held, at which the valuable right of way was obtained from the Indians on favorable terms.—*Dayton News.*

Grand Trunk Mogul.

The locomotive here shown is one of six recently built for the Grand Trunk Railway by the Schenectady Locomotive Works. These moguls are for heavy freight service and were designed under the supervision of Mr. F. W. Mórse, superintendent of motive power of the Grand Trunk. There is nothing very special about the design of the engines, more than that they establish a highly sensible type that will haul very heavy trains at small expenditure of fuel and little trouble for repairs, besides being very convenient engines to handle.

The cylinders are 20 x 26 inches; the driving wheels are 62 inches diameter outside of tires, and the boiler is 62 inches diameter at smallest ring, providing 2,001 square feet of heating surface. The weight on the driving wheels is 127,650 pounds. This gives a rotative force nearly 168 per pound of cylinder pressure. As the boiler pressure carried is 200 pounds to the square inch, this will give a draw-bar pull of nearly 25,000 pounds. The coefficient of adhesion is about 5 when working in full gear. This means that the weight upon the driving wheels is about five times the pressure exerted to slip them. That is a little more than the requirements of the Master Mechanics' Association rules, and tends to produce a locomotive free from the evils of wheel slipping.

The principal dimensions not mentioned are:

Weight in working order—152,850 pounds.

Weight on drivers—127,650 pounds.

Wheel base, driving—15 feet 8 inches.

Wheel base, rigid—15 feet 8 inches.

Wheel base, total—24 feet 1 inch.

Horizontal thickness of piston—5⅛ and 5⅝ inches.

Diameter of piston rod—3¾ inches.

Kind of piston rod packing—United States metallic.

Size of steam ports—20 x 1⅝ inches.

Size of exhaust ports—20 x 3 inches.

Size of bridge ports—1⅜ inches.

Greatest travel of slide valves—5½ inches.

Outside lap of slide valves—⅞ inch.

Inside clearance of slide valve—1-16 inch.

Lead of valves in full gear—Line and line.

Driving box material—Steeled cast iron.

Diameter and length of driving journals —9½ inches diameter by 12 inches.

Diameter and length of main crank pin journals—6½ inches diameter by 6 inches.

Diameter and length of side rod crank pin journals—Main, side, 7½ inches diameter by 5¼ inches; F. and B., 5½ inches diameter by 4 inches.

Tubes, material—Charcoal iron, No. 12, W. G.

Tubes, number of—291.

Tubes, diameter—2 inches.

Tubes, length over tube sheets—11 feet 11 inches.

Fire brick, supported on—Three 3-inch water tubes.

Heating surface, tubes—1,800 sq. ft.

Heating surface, water tubes—15.15 square feet.

Heating surface, firebox—185.85 square feet.

Heating surface, total—2,001 square feet.

Grate surface—33.44 square feet.

Ash pan—Sectional, dampers F. and B.

Exhaust pipes—Single.

Exhaust nozzles—4¾, 5, 5¼ and 5½ inches diameter.

The house is a handsome brick building, and stands on a lot that has a frontage of 180 feet by 360 feet. The property includes a three-story brick house and a two-story brick building, containing billiard room, large assembly hall and coachman's dwellings and stables. Both buildings are handsomely and substantially built, finely finished in natural woods, and are furnished with every convenience.

This is a remarkably well-timed gift from the family of Horatio G. Brooks, for he always took a very warm interest in everything connected with the comfort and elevation of his workmen.

The people of Dunkirk are very much gratified over the gift, and we feel certain that it will be used to good advantage.

SCHENECTADY GRAND TRUNK MOGUL.

Engine truck journals—6½ inches diameter by 10½ inches.

Diameter of engine truck wheels—37 inches.

Kind of engine truck wheels—Steel tired, cast iron, spoke center.

Style of boiler—Extended wagon top.

Outside diameter of first ring—62 inches.

Working pressure—200 pounds.

Material of barrel and outside of firebox—Carbon steel.

Thickness of plates in barrel and outside of firebox—21-32, ¾ and ½ inch.

Horizontal seams—Butt joint, sextuple riveted, with welt strip inside and outside.

Circumferential seams—Double riveted.

Firebox, length—120 inches.

Firebox, width—40⅞ inches.

Firebox, depth—F., 73¾ inches; B., 65 inches.

Firebox plates, thickness—Sides, 5-16 inch; back, ⅜ inch; crown, ⅜ inch; tube sheet, ½ inch.

Firebox, water space—Front, 4 inches; sides, 3½ inches; back, 4 inches.

Firebox, crown staying—Radial stays, 1⅛ inches diameter.

Water capacity of tender—4,500 United States gallons.

Coal capacity—10 (2,000-pound) tons.

Total wheel base of engine and tender —50 feet 10 15-16 inches.

Total length of engine and tender—61 feet 8 7-16 inches.

Engine equipped with: Three 3-inch Coale's safety valves, one muffled, two encased; Detroit triple sight-feed lubricator with Tippett device; American outside equalized brake on all drivers, operated by air; Westinghouse automatic air brake on tender and for train, 9½-inch air pump; Houston sand-feeding apparatus; tender brake beams, Sterlingworth, Marden patent; 6-inch chime whistle, No. 3, Crosby; two Ashcroft steam gages.

The Brooks Gift to the City of Dunkirk.

The daughters of the late Horatio G. Brooks, president and originator of the Brooks Locomotive Works, have given to the city of Dunkirk the fine homestead built by their parents, to be used by the Young Men's Christian Association as a hospital and free public library.

Antiquated Watering Facilities.

The old and mossy scheme of a peanut vender doling out drinking water to thirsty passengers from a gallon can with a tumbler attachment on top of same, reminds us that a few railroads in the country are still lingering in the lap of barbarism. We have lately, in our peregrinations in quest of something new, seen this stock-train style of watering people in transit, and wondered if the management were working the economy game, or whether they had heard about water-coolers. Impelled by curiosity in one (the first) instance, we followed the news agent into his lair, for the purpose of seeing what disposition was made of the water can between times. We found the can on the floor of the smoking car, in an atmosphere reeking with odors that could give points to an opium joint. Such water was positively unfit to give a human being, and we nursed a parched palate until an oasis was reached, reflecting the meanwhile that the traveler who had provided himself with a cold bottle was wise in his generation. There are people who drink water—sometimes, and on those occasions like a reasonably clean article

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The Journey of Water and Steam from the Tender to the Atmosphere.

We supposed that every intelligent engineer would have no difficulty in describing the journey made by water from the time it enters the tender until it emerges from the smoke-stack in the form of exhaust steam, until an incident happened a short time ago which convinced us that men with better opportunities than locomotive engineers of learning everything relating to the operation of a locomotive, sometimes displayed great ignorance of such elementary matters as following the water from the tender to the smoke-stack. A railroad official wanted a master mechanic, and he expressed himself to that effect in advertisements in the leading railroad journals. There were a great many applicants for the position, and several of the candidates were requested to send in their testimonials relating to experience and ability. Then several of the candidates in succession were invited to have an interview with the general manager. That personage followed a plan that master mechanics have been zealously urging as a condition for passing firemen and engineers for promotion—he requested the candidates to answer a variety of questions about the locomotive, and about various things that a master mechanic ought to know. The first five were rejected because they did not display accurate knowledge about the duties they would be required to perform. One of them was asked to follow the journey of the water from the tender to the smoke-stack, and to describe the principal events of the journey. He answered that he was a practical railroad mechanic, but that he did not know anything about theories of the steam engine, and on that account he would not attempt to answer the question.

We propose going over that journey and describing what we are supposed to see for the benefit of others who have been too practical to study "theories of the steam engine," or for those who have not had their attention directed to this matter. The answer that would have satisfied the enterprising general manager might have been given as follows: The water in the tender is drawn out by the injector and forced into the boiler. When there it comes in contact with the heating surfaces and is evaporated into steam. Then it passes into the dome and through the throttle-valve enters the dry pipe, which leads it forward to the steam pipes in the dome that provide passages, first through the pipes, and then through the cylinder castings into the steam chest. There it meets the slide valve blocking the way, but as soon as the valve moves, uncovering the steam port, a means of admission to the cylinder is gained. Then the steam rushes in and pushes the piston until the valve opens a way to the exhaust point, when away goes the steam through the exhaust passages, through the nozzle and out through the smoke-stack. Following that trip seems a very easy trip. If any of our young readers have any difficulty in following it, we advise them to take our educational chart No. 2, which shows a transparent picture of all the parts of the famous 999, and follow the route described. Very few mental journeys will make them perfectly familiar with the whole thing and will enable them to describe it verbally to their friends.

For more advanced people, such as master mechanics who have no objection to study theories about their business or about the machines they have to look after, we will dip a little deeper into the changes undergone by the water and the causes which produce these changes.

The water enters the tender at a temperature of 60° Fah. and the injector steam adds 100° and the feed water up to 160°. The water now circulates over the heating surface to find the heat necessary to convert it into steam. The gage steam pressure on the boiler is 180 pounds per square inch, which is about 195 pounds absolute pressure—that is reckoned from a vacuum. At this pressure water does not boil until it has been raised to a temperature of 379.5° Fah. Of course, we all know that with no pressure above the atmosphere water boils at a temperature of 212° Fah.

Now, suppose we are following one pound of water that left the tender with a temperature of 60°. An increase of 100° is given by the injector steam which brings it up to 160°. To bring it up to the boiling point, 219.5°, more heat units have to be imparted to the water. This being done, the process of evaporation begins, and the heating surfaces must add 850 more heat units to the pound of water before it is all converted into what is called saturated steam. The heat unit is an entity used for heat measurement and represents the amount of heat required to raise the temperature of one pound of water one degree at its greatest density, which is 39° Fah.

Our pound of water now being converted into steam by the addition of 1169.5 heat units, it is ready to proceed to business. It goes into the dome, and from there passes along the dry pipe and steam pipes to the steam chest. On being admitted to the cylinders by the opening of the slide valves it there enters a cooler place than the boiler, and part of the steam is condensed in doing the work of raising the temperature of the cylinders to its own heat. In this way about 25 per cent. of the steam is converted into water which has no power to push the piston, and thereby do useful work. The remaining steam pushes the piston along at nearly boiler pressure until cut-off takes place; then it continues the work to the period of release by the expansive force due to its high pressure. The exhaust port being opened, it rushes into the exhaust pipe and thence out through the nozzles and smoke-stack, creating in its way the vacuum in the smoke-box which draws the heat gases through the tubes at great velocity, producing the great steam making capacity for which the boilers of locomotive engines are famous.

There are certain other events of the stroke, such as the condensation of the steam in doing its work of pushing the piston, the re-evaporation that takes place at the end of the stroke and the compression that occurs at the end of the return stroke, that are well worthy of investigation and discussion. But the consideration of these matters would make an article of this kind too long, and we must leave them for future attention.

Effect of Scale on Fuel Consumption.

A paragraph without any paternity has been going the rounds of the engineering papers for many months. It reads:

"A scale of only one-sixteenth of an inch in thickness will interpose so much heat insulation between the iron and water as to require 12 per cent. more fuel than when a boiler is clean, while a scale of one-fourth of an inch in thickness will require an expenditure of more than double the quantity of fuel to perform the same duty. In addition to the great waste of fuel, other evils ensue, arising from scale, such as burning, crystalization, over-heating, and the weakening of the shell of the boiler."

We are no defenders of practices which permit boilers to become fouled with deposit and incrustating matter, and we have frequently expatiated upon the bad effects; but when we warn steam users about the evils resulting from bad water, we like to keep within sight of the truth. We once received a good object-lesson that has ever since inclined us to be careful in ascribing great waste of fuel as certain to result from a dirty boiler. The writer was running a locomotive whose boiler became badly fouled with mud and scale. The washing-out arrangements were bad, and the road was suffering from a plethora of business which prevented the men in charge from taking the engine long enough out of service to change the flues and clean the boiler. When the time came round for that work to be done, the boiler seemed to be a solid mass of mud and scale. To an onlooker it was a mystery how water got near enough to the heat gases to boil, yet the engine continued to steam fairly well until taken into the shop. When she came out with a clean boiler the steaming was not decidedly improved, and what seemed more strange still was that the fuel consumption was not materially reduced. There was not a tube but had at least one-eighth inch of solid scale, to say nothing of heavy coating of mud. According to the boiler-feed purifying authorities, the consumption of fuel ought to have been double what was needed for a clean boiler, but in reality the increase was so small that the fireman could not tell any difference.

Some seven or eight years ago a series of very carefully conducted experiments were carried out by a German scientific society to find out with some exactness the effect of scale on heating surfaces. A perfectly clean boiler was tried under varied conditions of draft and furnace forcing with soft water, and the results tabulated. Then water highly impregnated with sulphate of lime was fed to the boiler and the results noted. The tests were carried on until about ¼ inch of scale had formed over all the heating surface. When in that condition the evaporation of water per unit of fuel did not diminish 20 per cent.

Of course the presence of scale, mud or other non-conducting substances on the heating surfaces leads to over-heating, and on this account has a destructive effect upon the boiler. If for no other reason, it is desirable to keep boilers clean, and of course there is some waste of heat, because the fuel gases pass away at a higher temperature than they do when passing over clean steel or iron. But there is no use exaggerating the extent of loss, for every man in charge of a steam boiler that is likely to get coated with scale knows pretty well what the effect is, and to inform him with scientific pretense that it is much worse than it really is merely makes him cast doubts upon all statements that seem to have a scientific origin.

Extending Old Shops.

A man who has undertaken to rebuild an old dwelling house, and thereby convert an ancient structure into an up-to-date modern dwelling having all modern improvements, generally learns something before he is done. His experience does not move him to advise his friends to go and do likewise. The general experience is that you spend enough money to build a new house, and when done have an old one on your hands.

Altering of old houses to make them new has a close analogy in the extensive alteration of railroad repair shops with the view of changing antiquated buildings and designs into modern plants. When railroad officials have become sufficiently inspired by progressive ideas to agree that extensive improvements in their equipment for repairing rolling stock shall be made, and then set to figuring on the extension of existing buildings, we are ready to say, don't. Get a plot of ground where modern buildings can be properly arranged, equip them with first-class tools, if you have to borrow the money, and the investment will pay you in five years.

It is a long time since the writer was first asked by a railroad manager what he thought of certain extensive alterations he proposed making on his repair shops. He had made up his mind to make the changes, and merely wanted us to agree with his views, which we did, doubtingly. Years afterwards he joked us about the "error of judgment."

That case moved us to make a study of the gain and loss connected with the improving of old shops, and it seems cheaper in the long run to build new ones, unless the old shops have been built on a plan that admits of easy and natural extension.

One of the leading difficulties met with in extending old shops was the inconvenience of transmitting power to added rooms and buildings. Complex line shafting, rope transmission, far-reaching steam piping and divided motive power make the extra power alone a serious increase of expense. The use of electric motors has now eliminated this source of waste, and employing them may render shop arrangements admissible that could not be used economically five years ago.

Many railroad companies have found a hot fire that burned down old buildings and put antiquated tools beyond repair to be a blessing in disguise. The benefits came principally from the increased capacity of the new tools. The same benefit flows to some extent from the building of entirely new shops. When that is done, some tools that have cheated the scrap heap too long reach their natural and hard-earned destination.

It is wonderful the persistency that machine tools used in railroad shop display in resisting condemnation. There is a saying in England that no one ever saw a dead ass. The railroad machine tool appears to have taken the place of the ass in this country in its opposition to figuring as deceased. The sentiment that encourages this opposition is widespread and maintaining intact ancient surroundings helps to keep it alive.

Steam Reverse Gears.

We have had numerous inquiries as to why steam reverse gears were not used more extensively in this country, as some of the European roads are now using them. They have been quite thoroughly tested on both the Pennsylvania and Reading roads, and at one time were largely used on the old "K" class of engines, of which the "long-legged 10" was the first in use, coming on the road in 1881.

The first cost was considerable, and it was very difficult to keep them so that they would not "crawl" and keep changing the point of cut-off by allowing the links to drop down while running. Although they handle the valves in good shape when in order, the men get along just as well without it, and are a little more certain of the links staying where they want them. With the valves well balanced they do not handle very badly.

BOOK NOTICES.

"Gas, Gasoline and Oil Vapor Engines for Stationary, Marine, Vehicle Motive Power." By Gardner D. Hiscox, M. E. Second edition, revised and enlarged. Norman W. Henley & Co., New York. Price $2.50.

The first edition of this work was brought out by the author (in 1897, and reviewed by this paper at the time) in order to present to the American reader the practice of our engineers in the design of explosive motors; being impelled thereto by the fact that foreign literature on the subject barely touched on the product of above motors in this country. The present edition has new matter and data referring to the adaptation of above power up to date. The contents of the book embrace historical facts covering the progress of explosive motors, together with the theory of gas and gasoline engines, heat efficiencies, measurement of power by absorption and transmitting dynamometers and indicator. This is followed by the various types of motors, and their operation is plainly described from the practical man's point of view; the commercial side not being lost sight of, by the showing of cost of operation. The work is a valuable one to those using or having the care of such engines. There are 348 pages of reading matter and 270 illustrations, mostly half-tones, besides an appendix containing a list of patents issued in the United States for gas, gasoline and oil engines from 1875 to 1897, inclusive. The book is 6 x 9⅜ inches, and the fractional part of an inch is the only thing about it that leaves a bad impression; it should come off in the succeeding editions, and make the book a standard size.

"The Locomotive Link Motion." By Frederick A. Halsey, associate editor *American Machinist*, consulting engineer Rand Drill Company. Press of Locomotive Engineering, New York. Price $1.

The author of this book has long been an acquaintance of the students of valve motion on account of a comprehensive book on "Slide Valve Gears" which he prepared and had published eight or ten years ago. That book was highly popular, because the subject was treated in a simple fashion which any engineer or workman had no difficulty in understanding. So many authors of engineering books are ambitious to appear learned and profound that they write in a fashion that none but advanced students or professors can understand, and their pretentious works come out still-born. But that is not the way with Mr. Halsey. He displays no inclination to describe the movement of a slide valve, the vibrations of a link or the throw of an eccentric through abstruse mathematical formulas. He sees ordinary movements and describes them in plain English. That tendency is peculiarly conspicuous in his book on "The Locomotive Link Motion."

The author begins his work with a vigorous defence of the link motion from the aspersions so often thrown upon it and the apologies made by many engineers for using a valve motion with so many faults and so few virtues. The usual tone of apology for the shortcomings of the link motion is replaced in this book by the bold statement that its so-called weak points are elements of strength for locomotive purposes, and that it is the best valve motion ever tried for this kind of steam engine. Then follows a section of twenty-one pages treating of the slide valve. By means of the Scotch yoke or slotted cross head, the action of the slide valve and its relation to the eccentric are made very plain. The section starts out with a description of the primitive engine whose valve had neither lap nor lead and called for the eccentric being set at right angles to the crank. Lap is then added, the necessity for angular advance of the eccentric shown, and lead, exhaust lap and the events of the stroke plainly described, good diagrams being used to illustrate the text.

The link motion and shifting eccentric are compared in the beginning of the part relating to the link motion, then comes a discussion of the peculiarities of the stationary or Gooch link. But of course the principal part of the book is devoted to the shifting link, which is almost universally used for reversing engines in the United States. On a careful perusal of the book, we cannot think of any important point which the author has failed to discuss.

We do not know of any subject which excites so much interest among the rank and file of railroad mechanical men as valve motion does. The interest is by no means in proportion to the popular knowledge of the subject. But it indicates that mechanical men have a keen interest in what is really the key note of the locomotive steam engine. That being the case, we do not know anything which could enable these inquiring minds to obtain so much clear light about their favorite subject, as a careful study of Halsey's "Locomotive Link Motion."

Against the Equalizer.

There are certain railroad rolling-stock appliances which we have always considered beyond and raised above the realm of captious criticism, and in the front of them has been the spring equalizer which was designed many years ago to equalize the shocks transmitted by inequalities of the track to car and locomotive wheels. That has been one of our idols which seemed raised above objections or stone-throwing. But this seems to be an iconoclastic age, and our fane has been hit by a rock in no less a conservative body than in the New England Railroad Club. A member of that admired institution has done no less than stand up on his feet and assail the value and utility of the equalizer. He expressed wonder that the equalizer was allowed a place on a modern locomotive, intimating that it was a senseless device at best. The opponent of equalizers states his case in the following paragraph:

"In order to properly understand the necessity for a better method of spring suspension, let us take a four-wheeled coupled locomotive, in which the equalizer represents a very important item at present. The drivers in the forward motion meet all the joints, frogs and switch points first and transmit the shocks through the equalizer to the trailers; the trailers in turn, when they meet the bad joints, frogs and switches, send the shock forward to the drivers. In this you will observe there is a doubling of the shocks or vibrations, and at high speed the drivers being as a rule improperly balanced and carrying the main rod, have a tendency to lift, which not only causes flat tires and broken springs and equalizers, but makes riding anything but pleasant for the enginemen. Now it is in order to explain a more mechanical system, and when I say each pair of wheels should have its own distinct spring suspension, independent of all others, I hope, after going into details, there will be some here who will take up the matter and give it more study. The proper combination for each pair of wheels should be a half-elliptic spring with carrying capacity when drawn flat at least equal to the weight of boiler when full of water. To the ends of this elliptic spring should be attached spiral springs of lesser capacity than the elliptic spring, their duty being to absorb the rise and fall of the wheels, caused by bad joints, etc., particularly in freight engines, when shifting cars on sidings, etc., where the joints are, as a rule, very bad, when an excessive upward rise of the wheels closes the spirals, the elliptic spring then absorbs the thrust. As each pair of wheels meet the inequality, they rise and fall independently of each other, and the action is not felt by any other pair of wheels. To say the riding of the most up-to-date locomotive is scandalous is putting it mildly, and the reason for it can be readily understood after a casual inspection of the spring suspension as shown in the blueprints or drawings in our trade papers."

That may be all right, and the author may have the right bull by the horns, but we have had considerable experience with locomotives that had no equalizers, and we must protest in favor of those who have that so-called inefficient means of transmitting the track shocks to the whole running gear. To our memory, the difference between the two methods is about equal to the jerking motion of a bullock cart and the softened motion of a well-made buggy. Of course any man has the privilege of preferring the cart, but locomotive men who have to spend hours on the foot-board are liable to prefer the buggy motion.

A New England Man for Vice-President of Master Mechanics' Association.

We have received a letter from a railroad man of Boston, too late for going into our correspondence columns, which reads: "At every meeting of the Master Mechanics' Convention of late years there has been canvassing in favor of candidates for the honor of vice-president on geographical lines. Several times members were asked to vote for certain men because they were from the South, and it was urged that it would be a compliment to Dixie's Land to elect men from the Southern States. That sentiment resulted in the election of two good Southern members, one of whom will preside at the coming convention. Then others said it was time that the West was having recognition, and that sentiment brought about the election of two Western men who are also well worthy of the honor conferred upon them.

"Now I think it is only fair that another district should receive tardy recognition, and that a New England member should be honored with selection as a vice-president. There are so many able men in New England who would make excellent presiding officers, when their turn comes, that it would be invidious to mention particular names. The New England Railroad Club has been an excellent training school for presiding officers; the club is second to none for the work it carries on for the advancement of railroad interests, and the organization richly deserves the kindly recognition that the election of one of its members to be a vice-president of the Master Mechanics' Association would imply."

Railroad Managers Inviting Ruin.

When a statistician, a politician or a political economist writes a book, a pamphlet or an article saying that the unfairness displayed by railroad managers in granting favorable freight rates to certain shippers is inflicting injustice to the community at large and favoring large customers at the expense of the small ones, there generally goes forth vigorous protests from the railroad press, intimating that the critics of railroad management are communists or anarchists in disguise. We are afraid that the complaints about unfairness in regard to rates are too well founded, and railroad managers themselves have corroborated the truth of the charges in a fashion that there is no gainsaying.

We all remember the remarks made by Mr. Stickney, president of the Great Western, who intimated at a meeting of railroad presidents that they were all willing to agree on rates, and that after the meeting was over everyone hurried off to be the first in taking advantage of those who had been parties to the agreement. There has been an impression that railroad managers had become more virtuous since that time, but some remarks made by President Ingalls, of the Big Four, at the Tenth Annual Convention of State Railroad Commissioners, held at Washington last month, will lead the public to believe that the iniquity of rate cutting is to-day as rampant as it ever was. Among other things, Mr. Ingalls said:

"There is less faith to-day between railway managers with reference to their agreements to maintain tariffs than was probably ever known on earth in any other business. Men managing large corporations, who would trust their opponent with their pocketbook with untold thousands in it, will hardly trust his agreement for the maintenance of tariffs while they are in the room together. Good faith seems to have departed from the railway world, so far as traffic agreements are concerned."

Mr. Ingalls, who has scarcely a peer in America as a far-seeing railroad manager, does not look to railroad managers to establish good business management in their dealings between railroad corporations and the public, but to the Interstate Commerce Commission which is practically giving up private management in despair and appealing to the help of the Government to prevent the men in charge of railroad property from ruining the trusts reposed into their hands. In regard to the proposed change which would put upon the Government the maintenance of rates, he said:

"Who oppose this proposed legislation? First, certain people who desire the Government to own and operate the railways; second, others who wish that the Interstate Commerce Commission should make all rates; third and lastly, certain railway managers who are opposed to any and all legislation, and who object to any control, and believe that they should be left entirely alone. As to the first, very few people are ready to launch the Government into the management of 185,000 miles of railway and the employment of 1,000,000 men. The second and third represent opposite extremes. Is it not better for us to take a medium course? Making rates for the whole country is too prodigious a task for any one set of men, be they never so wise. On the other hand, the railroad manager who claims the right to act independently of all State control is twenty-five years behind the times."

Railroad freight is carried on rates close to cost in most instances, and yet the small margin between profit and loss is stretched to favor the big shipper, who gets his goods carried in many instances at a loss to the railroad company, while giving him the power to ruin his small rival. There is not much wonder under the circumstances that anti-railroad sentiment can neither be uprooted nor suppressed.

Specifications.

The above was the subject of an investigation and discussion at one of the railroad clubs lately. There was a time when we believed that the specifications sent out inviting bids on the construction of railroad cars and locomotives were intended to guide the bidders regarding the materials they were required to supply, but sad experience has convinced that, like the Chinaman's cards they are used "the same with intent to deceive." Specifications are the most reliable means by which a big concern can knock out a little one. The manager of a firm that is not particularly influential takes a specification, goes carefully over it and bids in good faith with the idea of using the material specified or something that meets the required tests. The manager of a big concern throws the specification aside and bids on the cheapest material in the market. If he gets the order, he goes to the superintendent of motive power and tries to convince him that the material he proposes to use is quite as good as those specified. If he does not succeed in carrying his point there he goes to the general manager, or even higher, and he generally carries his point.

If you want to send out specifications please do not let them stand as the sham they are notoriously to-day.

Rumors have been circulated persistently for the last year or two that railroad capitalists had obtained valuable concessions in China for the building of railroads, but somehow the rumors did not materialize. China did not display much desire to secure American capital or experience, and those who hoped for a market for railroad machinery in the Celestial Empire became involved in a cloud of gloom. A slight rent in the cloud came last month in the announcement that Captain W. W. Rich, a well known American consulting engineer, had been appointed consulting engineer to the Chinese Railroad Administration with headquarters at Shanghai. He will be in charge of all railroad building in China as assistant to the Director-General of Railroads. As Captain Rich can well appreciate the merits of American railroad machinery, as compared with that made in other countries, our rolling stock and tool makers may now look with confidence to securing a fair share of the Chinese business.

"Finances and Transportation" is the name of a small pamphlet published by J. D. Miller, of Chicago. It contains a fierce arraignment of railroad companies for the practice of favoring certain freight shippers at the expense of others. A great many statements are made to the effect that railroad managers are wicked tramplers on the rights of the people. The tone of the pamphlet may be judged from one of the closing paragraphs which reads: "Let it be remembered that the real anarchists of America are not the poor and hungry who are shivering in the cold, but those holders of public franchises who lodge in gilded palaces, and are by themselves or agents grabbing public property of the people and thus undermining the very foundation of popular government." The pamphlet is endorsed by Gov. Pingree, who says: "This pamphlet presents in their true light questions that immediately concern the American people."

One of our friends in Australia has sent us an illustrated prospectus of the Working Men's College of Melbourne. It shows a variety of scenes connected with the college, and gives a great deal of information about the instruction given. From the catalog we learn that very laudable efforts are being made in Australia to give workmen the benefit of education which can be acquired through their attending night schools.

PERSONAL.

Mr. W. J. Tollerton has been appointed master mechanic of the Oregon Short Line's Utah division.

Mr. L. L. Dawson has been appointed master mechanic of the Illinois Central shops, at Memphis, Tenn.

Mr. H. B. Spencer has been appointed superintendent of the Eastern division of the Canadian Pacific; headquarters at Ottawa, Ont.

Two sons of Road Foreman of Engines P. Walsh, of the Panhandle, are members of the Ohio National Guards and have gone to the front.

Mr. C. L. Millhouse has been appointed general manager of the Chicago & South Bend (headquarters at South Bend, Ind.), succeeding Mr. C. W. Stover.

Mr. W. H. Lawson has been made assistant superintendent of the Bellingham Bay & British Columbia, at New Whatcom, Wash., vice Mr. A. Branin.

Mr. W. D. Scott has been appointed assistant superintendent of the Northern division of the Great Northern, succeeding Mr. J. W. Donovan, transferred.

Mr. E. H. Harding has been appointed master mechanic of the Chattanooga Southern, vice Mr. J. H. McGill, resigned; headquarters at Chattanooga, Tenn.

Mr. J. W. Donovan, assistant superintendent of the Northern division of the Great Northern, has been transferred to the Montana division of the same system.

Mr. J. R. Hawkins, superintendent of the Wabash, Chester & Western, has been appointed superintendent of the Detroit & Lima Northern, succeeding Mr. Geo. R. Haskell, resigned; headquarters at Detroit, Mich.

Mr. J. W. Stokes, master mechanic of the Illinois Central at East St. Louis, Ill., has resigned to accept the position of master mechanic of the Columbus, Sandusky & Hocking Railroad, with headquarters at Columbus, O.

Mr. C. B. Royal, master mechanic of the Seabord Air Line, at Portsmouth, Va., was married April 20th, at Topeka, Kan., to Miss Kate E. Player, daughter of Mr. John Player, of the Atchison, Topeka & Santa Fé.

Mr. George Tozzer, assistant purchasing agent of the Cleveland, Cincinnati, Chicago & St. Louis, has been promoted to the position of purchasing agent, taking the place of Mr. A. M. Stimson, deceased; headquarters at Cincinnati, O.

Mr. F. H. Paine has been appointed general foreman of the locomotive and car departments of the Wabash, at Forrest, Ill., having resigned as division master mechanic of the Chicago & Alton at Slater, Mo., some months ago.

Mr. A. Gordon Jones, superintendent of the Anniston division of the Southern Railway, at Selma, Ala., has been transferred to the Macon division, with office at Macon, Ga., vice Mr. W. R. Beauprie, resigned on account of ill health.

It is reported that Mr. John Medway, superintendent of motive power of the Fitchburg Railroad, has retired, and that Mr. J. W. Marden, superintendent of car department, will take charge as superindent of machinery from June 1st.

Mr. Robt. R. Pott, of Pittsburg, who has had an office in the Park Building, representing the advertising department of the Chicago, Milwaukee & St. Paul Railroad, has resigned and entered the regular army to fight for Uncle Sam in the war with Spain.

At the annual meeting of the stockholders of the Joseph Dixon Crucible Company, the old Board of Directors were appointed, and they elected E. F. C. Young, president; John A. Walker, vice-president and treasurer, and George E. Long, secretary.

Mr. E. E. Steymer has been appointed superintendent of the San Luis division of the Mexican Central, with office at San Luis Potosi, Mex., taking the place of Mr. H. R. Cornforth, resigned. He was heretofore superintendent of the Mexico division of that road.

Mr. R. J. Woods has been appointed secretary to Vice President and General Manager Ramsey, of the Wabash. Mr. Woods was formerly with the "Big 4," and has gone through a railroad experience that makes him highly efficient as a general manager's assistant.

Mr. A. F. Conklin, the well-known railroad supply man, has accepted the general agency of the railroad department of the New Jersey Car Spring & Rubber Company. That company is to be congratulated upon securing the services of such a popular man as Mr. Conklin.

Mr. F. W. Barton, general foreman of the Illinois Central at Chicago, has been appointed master mechanic of the East St. Louis division in place of Mr. J. W. Stokes, resigned. Mr. Barton is an old-time friend of LOCOMOTIVE ENGINEERING, and has labored very assiduously to keep up our list of subscribers at Burnside.

Mr. William S. Morris, superintendent of motive power of the Chesapeake & Ohio, is one of the Board of Managers of the Virginia Mechanics' Institute, Richmond, Va. We are under obligations to Mr. Morris for sending us an invitation to the closing exercises of the night school of technology connected with the institute.

Our well-known contributor, Mr. W. de Sanno, of Tulare, Cal., got patriotic and tried to enlist as machinist in the navy, but having the mark of too many Eastern winters on his brow, they decided he was too old; even an honorable discharge from the old navy was no argument in the premises. They did the next best thing, however, by putting him to work in the department of steam engineering.

The following changes have been made on the Chicago Great Western: Mr. J. Berlingett has been appointed superintendent of the Southwest division (headquarters at Des Moines, Ia.); Mr. J. A. Kelly has been appointed superintendent of the Northwest division, with headquarters at St. Paul, Minn.; Mr. O. Cornelisen has been appointed acting superintendent of the Eastern division, with headquarters at Dubuque, Ia.

We regret to learn that Mr. J. N. Barr, superintendent of motive power of the Chicago, Milwaukee & St. Paul, has passed through an exceedingly severe illness. He was taken to Old Point Comfort some time ago, in hopes that the genial air of that district would help him, but it appeared to have little benefit, and he was moved to Long Branch, on the breezy Jersey shore. We understand that he is slowly recovering, and his friends hope that he will have sufficient strength to be able to attend the conventions in June.

Mr. W. E. Chamberlain, heretofore assistant superintendent of the New York division of the New York, New Haven & Hartford, has been appointed general superintendent of the Old Colony System, at Boston, Mass., succeeding Mr. E. G. Allen, resigned. Mr. Chamberlain rose through the car department of railway service and for years was a master car builder. When attending the Master Car-Builders' convention he was regarded as one of the most powerful men in shaping legislation. He took a vigorous stand in promoting the use of interchangeable parts, and not a small amount of the good done in this direction by the Master Car Builders' Association was due to Mr. Chamberlain's efforts.

The *Railway Age*, in a recent issue, has a very good portrait of Mr. C. J. Ives, president of the Burlington, Cedar Rapids & Northern. They have not taken up such a good subject for a long time. Mr. Ives is of the class that might be termed the salt of the railroad earth. His heart is always in the right place, trying to do the best for the interests he serves, and always careful to prevent those who have to endure the heat and burden of the day from having their labors made too oppressive. Modest, bright and far-seeing, Mr. Ives has always performed his duties with conscientious rectitude, whether as a clerk or a railroad president, and the force of duty well done has pushed him to the high position he now occupies. And that has come not from any scheming of his, but from the recognition of merit that came from the proprietors of the property he now manages.

We have not heard of any change in railroad management for a long time that pleased us so much as the news that Mr. W. H. Canniff, general manager of the Lake Shore, had been elected president of of the Nickel Plate. The selection of Mr. Canniff for that position is a recognition of merit and long, faithful service. Just about the time he changed offices, Mr. Canniff had been for thirty-four years on the railroad which he has left. He entered railroad service in 1863, as night watchman, from which position he advanced to station master, and then to track master. A few years later he was made division superintendent, and he made steady progress towards the top, which he has now reached. Mr. Canniff is a very pleasant, genial gentleman, and has always been highly popular with the men under his charge. There is not a detail of railroad operating that he is not master of, yet he is not given to meddling with the duties of his subordinates.

A frequent visitor to this office is Mr. James C. Currie, a level-headed Scotchman who long ran one of the fast express locomotives on the Pennsylvania Railroad, and left the foot-board about a year ago to become an agent for the Nathan Manufacturing Company. James is an exceedingly modest man, and has little to say when he comes to see us, but we lately discovered him in a new rôle, where his abilities shone forth with brilliant lustre. There was a great meeting of the Ladies' Auxiliary when the engineers' convention was on at St. Louis, and Mr. Currie was chosen to preside. It takes some coolness and self-reliance to preside at a great meeting where men only have to be controlled and introduced. It must be a hundred times harder to perform the honors properly when ladies have to be managed; but Mr. Currie was more than equal to meet all the embarrassments. We left the meeting under the impression that he was one of the best presiding officers we had ever seen filling a chair.

The retirement of Mr. J. M. Toucey, long general manager of the New York Central, takes away from railroad life one of the most prominent and active officials. When the recent changes in the management of the New York Central took place, Mr. Toucey was made assistant to the president, but he did not seem to find the change agreeable, and applied for retirement, which, we understand, has been granted, with full salary. Mr. Toucey has been forty-six years in railway service, the greater part of which has been passed on the New York Central and its predecessor, the Hudson River. He rose from the position of station master to that of general manager by gradual steps, every advance up being earned by valuable service rendered. Mr. Toucey took a great deal of interest in developing early railroad safety appliances, and was the inventor of several improvements in signalling. Personally he has always been very pleasant and agreeable to both high and low who came in contact with him in the performance of his duties, and general regret is experienced by the employés of the New York Central at Mr. Toucey's retirement.

EQUIPMENT NOTES.

Jones & Laughlin are building forty freight cars for the Pacific Coast Railway.

The Wells & French Company are building 600 cars for the Armour Car Lines.

The Missouri Car & Foundry Company are building 500 freight cars for the Texas & Pacific Railway.

The Omaha Packing Company have 100 cars building by the Missouri Car & Foundry Company.

The Barney & Smith Car Company are building thirty cars for the Colorado & Northwestern Railway.

Five engines are being built at the Brooks Locomotive Works for the Hankaku Railway of Japan.

The Pullman Car Company have two passenger cars under way for the Chicago & Northwestern Railway.

The Baldwin Locomotive Works are building six six-wheel connected engines for the Atlantic Coast Line.

The Delaware & Hudson Canal Company are having 150 cars built by the Jackson and Woodin Company.

The Baldwin Locomotive Works are building one six-wheel connected engine for the South Georgia Railway.

The Brooks Locomotive Works are building one six-wheel connected engine for the Tionesta Valley Railway.

The Toledo & Ohio Central Railway have 400 freight cars under construction by the Wells & French Company.

The Mount Vernon Car Company are building twenty freight cars for the St. Louis, Peoria & Northern Railway.

The Chicago & West Michigan are having one six-wheel connected engine built at the Schenectady Locomotive Works.

The Jackson & Woodin Company are building twenty-five cars for the Lackawanna Live Stock Transportation Company.

The Interoceanic Railway of Mexico are having twenty-four freight cars built by the Missouri Car & Foundry Company.

The Pecos Valley Railway Company are having eight eight-wheel passenger engines built at the Brooks Locomotive Works.

Two thousand, five hundred freight cars are being built for the Missouri Pacific Railway by the Missouri Car & Foundry Company.

The Nippon Railway Company of Japan have twenty-six engines under construction at the Schenectady Locomotive Works.

Eleven six-wheel connected engines are under construction at the Cooke Locomotive Works for the Southern Pacific Railway.

The Schenectady Locomotive Works are building ten six-wheel connected engines for the Chicago, St. Paul, Minneapolis and Omaha Railway.

The Chihuahua & Pacific Railway Company are having four consolidations and one eight-wheel passenger engine built at the Brooks Locomotive Works.

The Schenectady Locomotive Works entered the field as competitors for foreign locomotives one year ago. The first order booked was for twelve eight-wheel passenger locomotives, for the Kiushiu Railway of Japan, which was immediately followed by an order for ten duplicate engines for the Imperial Government Railway, of the same place. The successful operation of these engines has resulted in additional orders, amounting in all to seventy-two locomotives for Japan, while an order for eight locomotives has been received for the Interoceanic Railway of Mexico.

The Manchester Locomotive Works.

The Manchester Locomotive Works are devoting all their energies to the production of fire engines at this time, there being no activity in locomotive work. President Means, who succeeded the late Arteas Blood as presiding officer at these works, is admirably equipped with experience for handling the business end of the enterprise, having been brought up in it under the guidance of his father, who was treasurer of the original company.

The history of this company is embraced in the record rolled up since the "forties," when the first plant was engaged in the manufacture of cloth, from which enterprise it entered into machine construction, and later took up the building of fire engines, and later the building of locomotives. The policy of taking hold of anything in the machine line is still the dominating one with the management. The early locomotives built here made themselves a name that is still a memory with the old-timers who looked on their machines as a part of their very existence. The Michigan Central had several of them. Inside connected, hook motion, 6-foot wheel and a Bury boiler is the mental picture drawn of some smart engines built at these works in 1853. The later "Bloods" of the "seventies" were a potent factor in marking a new era for the four-wheel connected engine, and did as much for the development of the standard American engine as any other build.

Locomotive Engineers' Convention.

The Brotherhood of Locomotive Engineers met in their biennial convention at St. Louis on May 11th. The 538 divisions were represented by 384 delegates, 48 divisions were not represented, and 106 divisions were represented by combined delegates.

The delegates were a fine class of men, and the members seemed to give practical effect to their policy of advancing the oldest men, for about 70 per cent. of the delegates were gray haired or had bald heads. There was no business before the convention, as far as we could see, that was likely to excite much diversity of opinion. The question of federation with other railway orders was to be discussed, but it had not come up at the time LOCOMOTIVE ENGINEERING goes to press. As far as we could judge from the tone of the delegates, there was little likelihood of it being passed.

A Fine Motor Carriage.

During a recent visit to Cleveland, the writer enjoyed the pleasure of riding about the city on the Winton motor carriage, hereby illustrated, in company with the owner and engineer, Mr. George Weiss, well known to railroad men as the representative of the Butler Draw-bar Attachment and other specialties. Mr. Weiss is shown in the engraving sitting beside his wife, who is a daughter of the late William F. Turreff, superintendent of motive power of the Erie.

This motor carriage is operated by gasoline, and is unquestionably the highest development of this means of locomotion. We understand that the patentees and builders of this motor carriage have a standing challenge to all other motor carriages to race 1,000 miles, which has not been accepted. The leading claims made for this vehicle are: Absolute safety; freedom from noise, heat or vibration; ease of handling; perfect control; economy of operation and power; elegance of design; handsome and durable finish; non-liability to get out of order; and all parts interchangeable.

From what we saw of the machine, we incline to believe that all the claims in its favor are well founded. It is perfectly free from odor, is as easily handled as a bicycle, rides as smoothly as a swing and passes everything encountered on the road, including trolley cars. The cost is $1,000. We understand that Mr. Weiss has an interest in the company making the machine.

OUR DANGEROUS RIVAL.

Pennsylvania Big Class H5.

The Pennsylvania Railroad Company's new Class H5 locomotive, No. 872, shown in the accompanying photograph, was recently turned out of the Juniata Shops, at Altoona. While it has been in service but a few days, it is showing evidence of splendid working ability. Following are some of the details of the giant:

Weight in working order (est.)—218,000 pounds.

Weight of tender, loaded — 92,600 pounds.

Capacity of cistern—6,000 gallons.

Number of pairs of driving wheels—Four.

Diameter of drivers—56 inches.

Size of driving axle journals—9 x 13 in.

Length of driving wheel base—17 feet 6 inches.

Total wheel-base of engine—25 feet 11½ inches.

Number of wheels on engine truck—Two.

Diameter of wheels on engine truck—30 inches.

Spread of cylinders—90 inches.

Size of cylinders—23½ x 28 inches.

Travel of valve—6 inches.

Type of boiler—Belpaire.

Minimum internal diameter of boiler—70½ inches.

Number of tubes—369.

Outside diameter of tubes—2 inches.

Length of tubes between tube sheets—168 inches.

Size of firebox, inside—40 x 120 inches.

Fire-grate area—33⅓ square feet.

Total heating surface of boiler—2,977 square feet.

Steam pressure—185 pounds.

Tractive power per pound of M. E. P.—288.

A radical departure from Pennsylvania standards is found in the H5 cylinders. These are bolted to the saddle, which is a single casting. Ball joints between the cylinders and saddle prevent the escape of steam. This method of fastening the cylinders will allow a variety of repairs to be made without shopping the engine.

Another new feature is the position of the injectors, which are placed at the head of the boiler, above the firebox door, instead of at the back of the cab.

In the preliminary tests made on the Pittsburg division, it was found that the H5 could handle 578 tons light, and 643 tons loaded. The record of the standard Class R freight engine is 350 tons light and 383 tons loaded, and for the Mogul, 375 tons light and 433 tons loaded. It will be seen from this that the Class H5 will eclipse any other locomotive on the Pennsylvania system.

The engine is too big to be turned on any of the Altoona turntables, and she therefore is used as a helper above Altoona, backing down the mountain.

John Alexander's Stories.

McClure's Magazine has begun publishing the stories by Mr. John A. Hill, which appeared from time to time through several years in LOCOMOTIVE ENGINEERING. Mr. Hill wrote under the *nom de plume* John Alexander, and his stories were very popular. When McClure's people finish publishing the stories in the magazine they will publish them in book form. "The Polar Zone" appeared in the May number, and "A Peg-Legged Romance" appears in the June issue. Those of our readers who have read these stories will enjoy reading them over again, and those who have not enjoyed that pleasure should take care to read them in *McClure's Magazine*. Our readers will readily agree that anything written by the author of Jim Skeever's Object Lessons is well worth reading.

There are originality and freshness in the writings of Mr. Hill that are certain to appeal to readers satiated with the stereotyped gush of the common story-teller. On this account we predict great popularity for Mr. Hill's book.

Car Department.

CONDUCTED BY O. H. REYNOLDS.

A Light Passenger Coach.

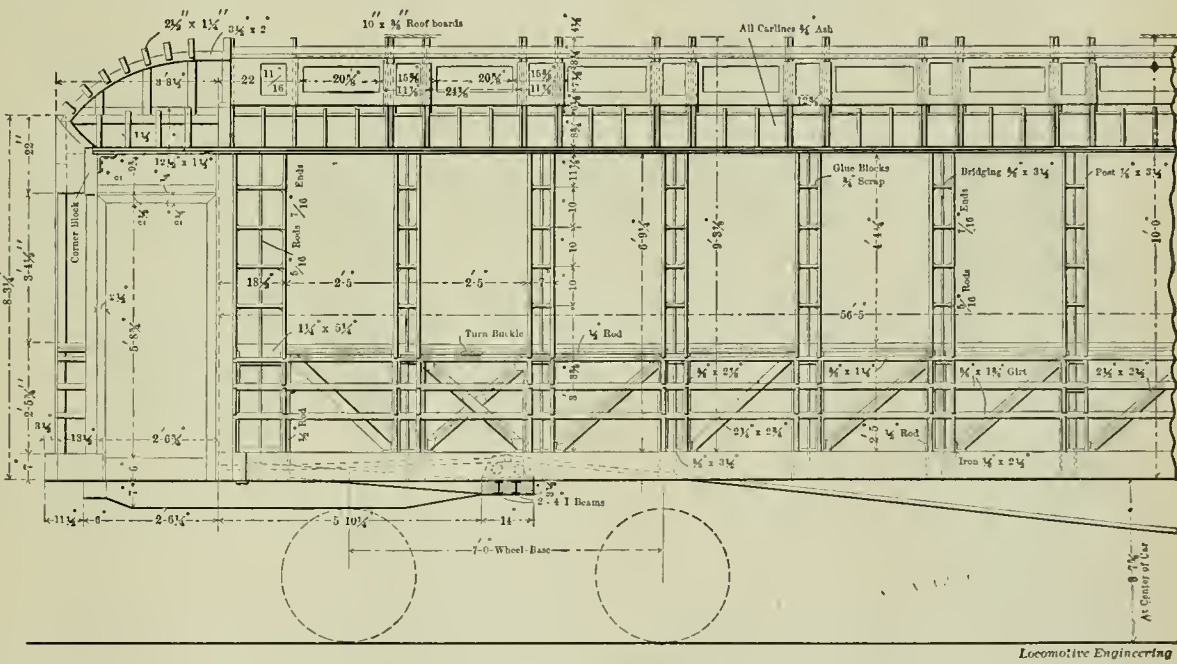
In the engravings of the framing of a passenger car, we present an example of light construction on the New York, New Haven & Hartford Railroad, that will be an interesting exhibit for all car men and an object-lesson to that contingent who believe the strength of a coach is indicated by excessive weight. It will be seen that there is no wide variation from established standard lines in the design of the car; in fact, it is built closely to the familiar outline and arrangement of detail of coach work in so far as appearance goes, but this ends the simile. Everything is cut down to a point, probably lower than ever before attempted in work of the kind.

The dimensions of some of the principal details will show how far this lightening process is carried. Posts are ⅞ inch thick, or one-half the size of general practice; plates, 1¼ inches thick (a reduction of more than one-half); girths, ⅝ inch thick (also less than one-half the thickness as usually made); sheathing and roofing, ⅜ inch thick; bridging between posts, ⅝ inch thick, and ditto between sills, 1 inch thick. The braces are shown fluted, and for a purpose, for the cutting away of the material reduces each brace to a little over 1 pound in weight. The flooring also comes in for its share of pruning; the lower course is ½ inch and the upper ¾ inch thick. Going back to the upper frame, the carlins are found to be only ¾ inch thick, of ash, while it is not unusual to find a wrought-iron carlin of that thickness.

All wrought-iron parts in the car body show the same heartless use of the knife to save weight—the post rods being double, of 5-16-inch iron, and welded at the center; two rods having less than one-half the area of the usual ⅝-inch rod used for the purpose. The truss rod for holding up the overhang from the body bolster is but ½ inch diameter, and passes over the top of the braces with the ends turned down, and going through the sills at each side of the body bolster. The turnbuckle over the crossed braces explains what can be done with this arrangement of trussing.

This car was designed by Mr. E. E. Pratt, superintendent of buildings of the New Haven system, and one of our veteran master car builders. It was built under the supervision of Master Car Builder Appleyard, and was put in service in November, 1896, between New York and Boston. It had run up to January 1, 1898, 59,881 miles. As to the total reduction in weight effected by cutting down of the framing, we quote, by permission, an extract from a letter to Mr. Pratt from Superintendent of Motive Power Henney: "The average weight of the standard passenger coach on this road, which will most nearly mate the light coach, is 59,500 pounds, including seats. The weight of the light coach, including the proposed aluminum seat frames, all ready for service, would be 51,750 pounds. Thus in the light coach we have effected a saving in weight of 7,750 pounds."

There are a great many passenger coaches running that are much heavier than the New Haven's standard noted above, some even weighing 65,000 pounds, and by the showing made, a saving of 12½ per cent. in non-paying load is had by attention to the body of the car alone. The trucks were not touched. This means that eight of the light cars could be hauled at practically the same expense that is required to get seven of the heavy ones over the road, and with a corresponding increase in revenue for the former. It is with no little satisfaction that we make note of the results achieved by the reduction of weight in this car, for it is a subject on which we have rung the changes to good purpose heretofore, and shall continue the work until the weight of cars, like the one under discussion, shall bear the lowest possible ratio to paying load. Passenger-train cars are worse offenders in this respect than any other, and a raid on their weight is always timely.



FRAMING OF N. Y., N. H. & H. PASSENGER CAR.

Development of the Car Spring.

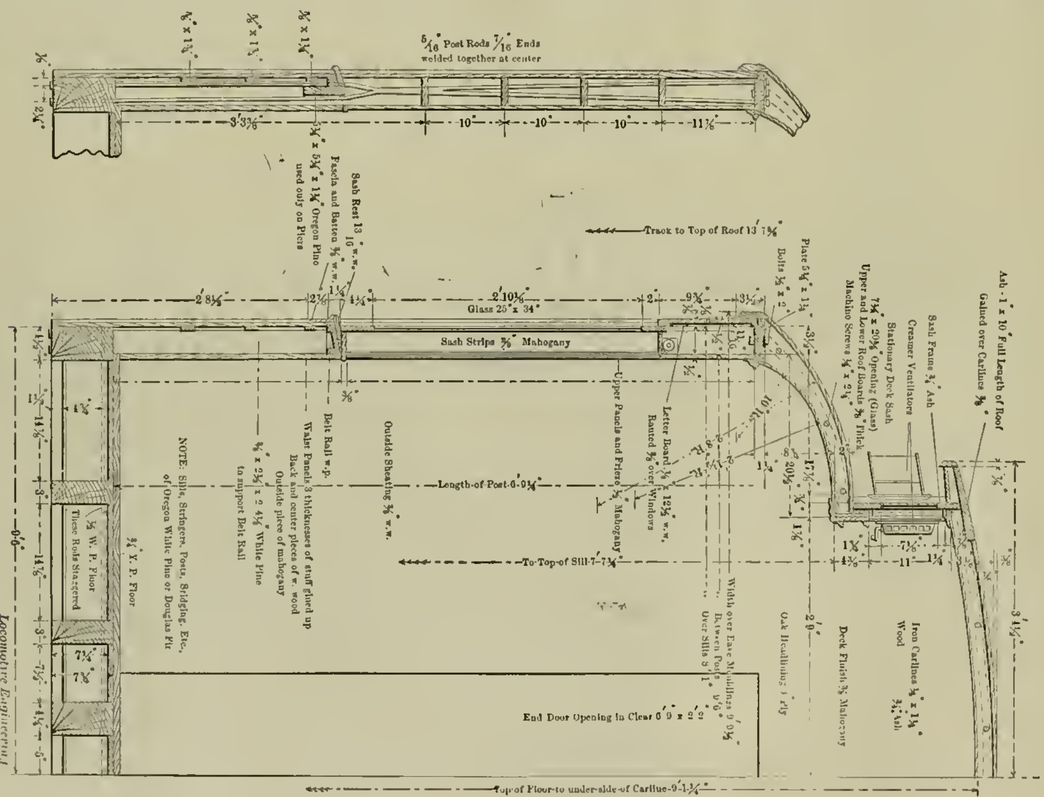
The early cars were built without springs. The first railroad managers, like those of other countries, did not think that springs were necessary to soften the shocks imparted to the wheels running on a railway, and it was only after the engineers discovered that the unresilient blows injured the track that the propriety of introducing springs was acknowledged. The dislocating of a passenger's anatomy by endless shocks did not cost railroad companies anything, but a disorder which called for the premature renewing of rails demanded immediate attention. For a long time the springs employed were very defective, and the bumps of rough track joints had few of the old terrors taken away. A thorough reform in this respect was effected principally by the labors of one man.

Fifty years ago in the forests of Ohio there was a very bright boy apprenticed to a blacksmith. This boy was fond of hunting and trapping. There were plenty of beavers, otters, musk rats (Ondatra zibethicus) and other water animals in the region where this young blacksmith was in the habit of trapping. In the course of time he found out that there was great difficulty in making the springs employed on the traps hold their temper while kept continuously under water. He proceeded to question all the blacksmiths within a week's journey, as to what they knew about tempering springs, and did not learn anything. Then he went to the nearest library, and read all there was to be found about the tempering of springs. Partly by the knowledge thus obtained, and partly by original experiment, he succeeded in devising a method of tempering trap springs, so that they held the temper while under water.

The making of springs became this blacksmith's hobby. Delving for information about the working of steel was his favorite amusement. In the course of time he became foreman of a railroad blacksmith shop, and then put his hobby into practical operation, to the end of making and tempering springs to carry with resilience the load they had to bear. Before that time the formula of spring construction followed was: "Make it strong enough to bear the heaviest load or severest shock, then double its strength for the sake of durability." The springs designed on that principle had about as little elasticity as an iron axle, and locomotives and cars rode so roughly that trainmen complained that the vibrations shook their teeth loose.

After a few years more, the blacksmith with the spring-making affinities, whose name was Aaron French, became the head of a spring-making establishment. One of his first transactions was to ask permission to put a set of springs under a car much used by the leading officials of the Pennsylvania Railroad. The springs he replaced weighed 2,800 pounds, and those put in weighed 1,600 pounds. The officials were at first incredulous about the springs carrying the load safely, but a few trips in the car convinced them that they were mistaken, and the car rode so smoothly that the springs for all the passenger equipment were gradually changed to conform to the expert's calculations.

That was the beginning of a change which converted American rolling stock to the smoothest riding vehicles in the world. The soft-gliding parlor car, that rushes through space at sixty miles an hour without a harsh shock or jar, has been brought to its present perfection by a variety of adjusting devices; but the scientific design of springs has contributed more than all else to make it a marvel of easy riding. Good seats, comfortable heating, sleeping berths and dining cars, have all contributed their share towards making railway travel comfortable; but all combined have done less than the improvement in car springs. A day spent in a rough-riding car is a day of nerve conflict, and the conflict rages fiercer if the victim lies in a sleeping berth, subject to the incessant tiny blows that weary the flesh. The morning finds those who have gone through this ordeal worn out, with the body a bunch of aches and a reservoir of resentment.—Angus Sinclair, in *The Pall Mall Magazine.*



FRAMING OF N. Y., N. H. & H. PASSENGER CAR.

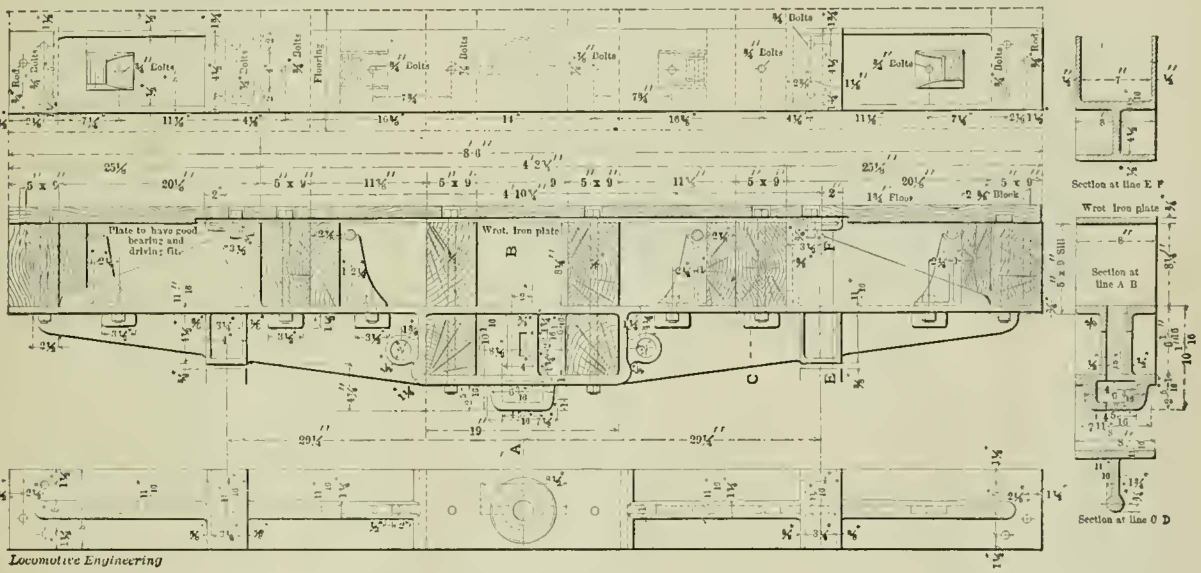
The Use of Malleable Iron in Car Construction.

Years ago cast iron was the cheapest metal that could be used for castings, and cars were not limited to weight, but at the present time we have to take into consideration weight, durability, cost of construction and maintenance. Castings must be made as light as is consistent with safety to keep down the dead weight, so malleable iron was substituted for cast iron. By its use the weight of an ordinary 34-foot box car has been reduced from 1,200 to 1,400 pounds, and other cars proportionately. It is evident that these figures are worth considering when multiplied by a large number of cars; as, for instance, in a train of forty cars, the weight or dead load is decreased 24 tons.

About two years ago it became more and more evident to Mr. G. F. Wilson, S. M. P. & E., of the Rock Island Railroad, that the wrought-iron bolster, as generally constructed and used almost exclusively in their freight equipment, could not carry the load without resting heavily on the side bearings, and the result of this was sharp flanges. Mr. Wilson made up his mind to make another effort to accomplish an improvement, and gave the problem to his chief draftsman, Mr. G. A. Akerlind, for solution. Mr. Akerlind and his promising young assistant, Mr. J. T. Carroll, set to work, and after much study as to the use of cast steel or malleable iron for their purpose, finally came to the design as shown by drawings.

This bolster, as will be noticed, can take the place of the old wrought-iron bolster, and also allow the use of the long draft timbers, which is very essential to a strong and durable draft rigging. This bolster, as will be seen by the engraving, is constructed of two parts; the compression member being a malleable-iron beam having center plate and side bearings cast on, and openings cast in allowing the draft timbers to pass through, which gives a long draft timber; but if it is desired to use a short draft timber, the openings in the casting can be cast solid and add to the strength of the bolster. The tension member is a wrought-iron or steel plate turned over at the ends and welded, and a reasonable fit should be made between this tension member and the malleable-iron compression member. At a glance can be seen the advantages that are gained both in strength and simplicity, reducing the number of parts to a minimum. The weight of this bolster is 550 pounds, complete with truss-rod supports.

The experience of the Rock Island people had convinced them that a successful draft rigging, as used in their freight equipment, must be longer than to the bolster. To design a bolster to admit the continuance of the draft timber through it has been a stumbling-block to most previous efforts; but, as seen, this problem has been very successfully solved by the designers. To the National Malleable Casting Company, of Chicago, is due the credit of having cast the first bolster of this kind. They exhibited one of these bolsters at the M. C. B. convention at Old Point Comfort in June, 1897. The following results of tests of this bolster show it to be a strong one:



MALLEABLE IRON IN CAR CONSTRUCTION.

BOLSTER TEST.

The desired pressure was applied at the top center plate, which was cast, by means of a wheel press with two gages, the two ends being blocked, making the distance between supports 8 feet 1 inch.

First test—Load, 40 tons; 5-16 inch deflection; 1/8 inch permanent set.

Second test—Load, 50 tons; 21-32 inch deflection; 1 3-32 inch permanent set.

The permanent set of test 2 was largely in the part between the side bearings. The tie bar also gave considerably at the hooks on end, as shown by their bending backward.

The blocking of the ends was then moved farther in, being nearly over the side bearings on each side, with 4 feet 8 inches between centers; pressure was then applied so as to rupture the bolster, which occurred at 75 tons pressure, and with an additional deflection of about 15-16 inch just before breaking.

The fracture occurred at the same time in both top and bottom longitudinal ribs above and below the space for draftwoods, at the outside corners, and also the corners on same side where reinforce for center pin and plate fills in between the ribs.

The tests 1 and 2 should give the maximum strain in the tie bar, and as 50 tons at the center is more than the bolster would have to stand supported at the ends, it shows that it is of ample strength.

With 75 tons center load and supports as in tests 1 and 2, the tie-bar strain with no bending in the center of the bolster would be

$$\frac{37.5 \times 22.5}{8} = 105 \text{ tons} = 210{,}000 \text{ pounds},$$

or 35,000 pounds per square inch of metal in the 8 x 3/4 tie bar, which, less the force required to bend the bolster at the corner above the side bearings, would bring the strain about up to the elastic limit of wrought iron, but not to the point of rupture.

On the other hand, at 75 tons pressure the longitudinal ribs above and below the draftwoods rupture by the transverse shear at the center, showing that the bolster considered as a trussed beam supported at the extreme ends with a center load, is of ample strength, and if the open space now left for the ends of the draftwoods could be filled in by a vertical web, the strength would be largely increased, and consequently the deflection and permanent set would be reduced, as the resistance shear at that point is much less than the total transverse strength of the bolster considered as a beam support at the ends with a center load.

The broken surface showed an excellent fracture, and even the reinforced bottom edge of the center vertical web was completely annealed, and from the way it bent proved it to be very ductile and free from brittleness.

An Old Hospital Car.

Once in awhile it's a good thing to look over some old publications and note how many of our brand-new, up-to-date ideas were old years ago, perhaps before we were born. It sort of takes the conceit out of us, and gives us a little more respect for the gray matter the old 'uns wore under their hats.

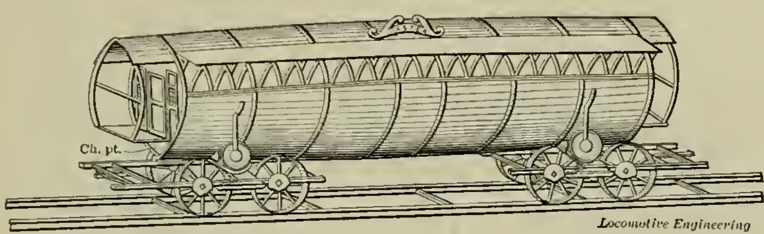
In looking over a report on Steam Engineering at the Paris Exposition of 1867, by W. S. Auchincloss (of link motion fame), we find a brief description of an American hospital car, built by William Cummings & Son, of Jersey City, N. J. This was shown by a model one-quarter size, and was said to be complete in all its appointments.

The litters were hung instead of being rigidly fastened, and other little details are mentioned. This isn't so bad for thirty-one years ago.

A Curious Passenger Car.

A curio of the car kind is shown in our engraving of what was called by its inventor, George S. Hacker, a barrel-car. It is a reproduction from the original drawing, which was made at Charleston, S. C., and formed a part of the letters patent No. 1937, of January, 1841.

As its name implies, the body was a barrel, and built up like one, of staves and hoops, a portion of the body being open the whole length on each side in order to admit light and air by means of sliding windows. Entrance was had by means of platforms and end doors, and the roof extended to the end of the platform—details very similar to present usage. While this car has the appearance of a freak, it lived beyond the patent stage and was in service on the South Carolina Railroad, hauling freight and passengers. This road has the distinction also of having been the first American railroad to have an American-built locomotive.



CURIOUS PASSENGER CAR.

A Heavy Electric Motor Car.

Some French engineers are experimenting with an electric motor car, heavy enough to haul a train and carry passengers as well. The car complete weighs 96,000 pounds, is 36 feet 9 inches long, and has a floor frame of 10-inch channel bars. The trucks are the Brill No. 27 type, especially designed to meet the requirements, which are severe and rather peculiar. They must perform the work of a locomotive in hauling the train and also the functions of a car truck. The essential features of the truck were described on page 15 of our January issue, although these differ in being heavier, and adapted to the service in question. The wheels are cast iron, 45 inches in diameter; journals, 4¼ by 6 inches.

Each truck carries a pair of 150 horsepower motors, or an aggregate of 600 horse-power. The trucks weigh 11,030 pounds each; the motors, 10,000 pounds per pair, and the car body, 24,000. The remaining weight is made up by ballast for tractive purposes.

The Steel Platform Saved Lives.

The collision on the Pennsylvania railroad on Friday last, wherein the "Chicago Limited" ran into a construction train at Bristol, Pa., was remarkable for the slight damage done to the coaches and the casualties to passengers. The president of a Western railroad, one of the best-known railroad men in the country, was a passenger on the train, and gave it as his opinion that to the fact that all the cars in the "Limited" were equipped with what is known as the Standard steel platform was largely attributable the safety of the passengers and the condition of the cars after the accident. The steel platform has come into use within the past two years, and all new Pullman cars are equipped with it. One of the principal claims that had been made for it was that by its use telescoping of cars is impossible. The accident on the Pennsylvania was the first practical test of the steel platform in collision, and its effectiveness is a topic of much interest in railroad circles.—*Pittsburgh Post.*

Electric Train Lighting.

An English method of driving dynamos for train lighting is rather ingenious, and has been in successful use for some time, if reports are correct.

This is the "Stone" system, and though the dynamo is driven from the axle as usual, the dynamo is suspended on a spring arrangement that gives as the pull increases, allowing the belt to slip, so that the dynamo cannot be driven at too high a speed.

The dynamo charges storage batteries as usual, but this method of preventing too high voltage is a departure from existing practice.

Chicago, Milwaukee & St. Paul Pioneer Limited Train.

The magnificent new train recently put in service on the Milwaukee road is said to be finer in its appointments and appearance than any other train yet turned out. It was built by the Barney & Smith Company, and elicited the greatest praise on its triumphal route from the works to the owners.

The cars are painted the standard yellow color of the road, with gold ornamentation for panel decorations, of the highest type of quiet elegance, in which the Empire style of design in combination with the Greek gives an idea of luxurious enjoyment that cannot fail to make the train famous for its art effects.

The compartment cars have seven double compartments, besides two drawing rooms, with a corridor the full length. The compartments are finished in St. Jago mahogany and Circassian walnut, and all draperies are chosen with a view to match artistically the different colored woods.

The buffet cars have all the most modern schemes for enjoyment of its patrons, with an observation room, card room and buffet, with all that is implied in the latter. They are finished similarly to the compartment cars. The sleeping cars are fully up to the mark reached by the other cars, in point of royal magnificence. There are sixteen sections, with the usual smoking and toilet compartments. The color effect in the interior finish and draperies is a dream in blending of blue. The Milwaukee is said to have outdone them all in this train, in which no expense has been spared to give its patrons the best of everything that goes to make travel a solid comfort as well as a luxurious pleasure.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Engine Truck Brakes.

While the engine truck brake is gradually and firmly winning its way into favor as a real safety appliance, still there are yet a few who believe it to be more of a luxury than a common benefit. That this is a mistaken idea will be seen by looking on both sides of the question.

A correspondent objects to the truck brake on the grounds that it takes him longer to change truck springs on engines equipped with truck brakes than on those not so equipped. He sees but one side of the question. The truck brake to him is merely an interfering device which is in his way while he is doing other work. It has no value whatever in his eyes. He fails to see the benefits derived from the truck brake in shortening the stops daily on the road. He does not consider that it is always the last few feet where the damage is always done, and that in many cases no accident would have occurred had it been possible to stop the train in 30 or 50 feet less.

In one of the great wrecks where the loss of life was heaviest, it was ascertained afterwards, upon investigation, that had it been possible to cut off 50 feet from the stop, not a single life would have been lost. Practical demonstration has proved that on a five-car passenger train, properly braked, the truck brake will cut off 41 feet in an emergency stop at 40 miles per hour, 73 feet at 50 miles per hour, and 116 feet at 60 miles per hour. Surely these figures should demonstrate an advantage that would outweigh the disadvantage of a dollar or two additional roundhouse expense and a delay of an hour or so.

Air Brake Hose Specifications.

The practice heretofore of railway companies, in purchasing air-brake hose, has been to take any hose of proper dimensions that would stand a pressure test, but past experience has proved that this is superficial and inadequate, and other real tests are needed.

A few months ago, one of the leading hose manufacturers sent out in an advertising pamphlet a code of qualifications, which he considered a first-class air-brake hose should possess. This code has been received by railroad people with more favor than even the manufacturer himself might have dared to wish. One large line has already adopted the code practically as it stands. Another has slightly modified it before adoption. Others still have framed requirements of their own, based on the manufacturer's code. Probably there are roads that have had some kind of requirements for air-brake hose for some time past.

One company requires a bursting test of 650 pounds, and a proof-pressure test of 300 pounds. Another company has adopted a test to determine flexibility. The hose is put in a machine and is subjected to a bending test similar to a hose swinging uncoupled at the end of a car. A third road requires that a hose shall give a certain term of service, and that the manufacturer shall take back, paying freight charges, all failing hose. This is certainly a good contract for the railroad.

Judging from the betterment in air-brake hose which the recent agitation has effected we can expect fewer troubles from poor hose and the total disappearance of the so-called tin-pipe hose which kinks and cracks the first time it is bent.

Cleaning Triple Valves.

With the rapidly increasing number of air brakes in freight-train service, the question of cleaning triples becomes a serious one, which will sooner or later demand its due share of attention.

Some roads have made a creditable attempt to maintain their air brakes in good working condition. Others, apparently believing the brakes automatic in maintenance as well as action, have given them little or no attention. The air brake is not a selfish piece of mechanism, requiring incessant care, but, like all machines, it demands a certain amount of attention. If this required attention is denied, it will surely rebel, and will make its effects felt in expensive break-in-twos which far exceed the cost of oiling.

A dry piston packing ring gives little trouble as compared to a dry slide valve seat. The former will work fairly well, but the latter renders the valve jerky, and increases the tendency towards quick action when not desired. Doubtless many engineers have been blamed for roughly handling a train, when the true cause lay in neglected triple valves.

It has been said that the constantly increasing number of air brakes renders it difficult, and sometimes impossible, to clean all triples on a large air-brake road as often as the air-brake men prescribe. Granting the difficulty, it is not to be supposed that a constantly increasing amount of work can be done to-day by a certain force of men that was only adequate when half the amount of work was required several years ago. Considering the increased earning capacity given a car by equipping it with air brakes, it would appear ungrateful to grudgingly deny the brake the little required attention, which to it is the necessity of life.

Air-Brake Inspector's Identification Sheet.

Railroad people generally are not aware of the large number of different kinds of triple valves, good, bad and indifferent, now in various degrees of service on freight cars, and will be somewhat surprised when they see the air-brake inspector's sheet illustrated herewith. Indeed, no one outside of the air-brake inspector or repairman would have suspected that there are at least nineteen different styles of triples to care for. All of these different makes claim to be interchangeable with the standard form, but the interchange feature, when narrowed down to the exact truth, means that the flange and holes therein for bolting the triple onto the auxiliary reservoir, are the only parts wherein similarity exists. The component parts of one make of triple valve will not fit in the triple of another make. The piston, the piston packing ring, slide valve, graduating valve, emergency valve, emergency piston, graduating spring, emergency check valve, slide valve bush, piston bush, valve cap, valve body—all of these, of one make of triple valve, fit that make, and will fit no other.

Nearly half of the triple valves herewith illustrated do not, in one way or another, meet the master car builders' requirements, and consequently lack that harmony of operation so necessary in long freight-train control. Not only do they lack this harmony themselves, but through this lack they interfere with or destroy the otherwise existing harmony in the same proportion that they are mixed with harmonious working brakes.

The men who first see and note these things are the air-brake inspectors and repairmen, the men who come in daily contact with the brakes, and it is through them that we should expect to learn of these troubles and hear complaints. At the Air-Brake Men's Convention at Baltimore, in April, one inspector complained that he was obliged to deal with and care for twenty-two different types of triples. Another complained of the large number of repair parts he was obliged to carry, and, after quite a lengthy discussion, it was unanimously voted that the Air-Brake Association adopt the M. C. B. code of recommended practice for test of triple valves. It is to be hoped that the M. C. B. Association will soon adopt as its standard for triple-valve tests, the code of recommended practice, for at present there is nothing to prevent the entrance of the poorest kind of triple valve into railroad service, providing its maker can find a purchaser.

CORRESPONDENCE.

A Fraudulent Representation.

Editors:

Information reaches me from a reliable source that one of the correspondence schools, which seems to have more assurance than discretion, has been perpetrating a fraud upon some of the enginemen of different parts of the United States, by representing that the undersigned has charge of, or is in some way connected with its air-brake instruction department.

A certain institution of the class mentioned, having its headquarters in Chicago, purchased, some time ago, a few copies of my book, "Diseases of the Air-Brake System," and distributed them amongst those taking scholarships with them. In itself this certainly affords no grounds for complaint. The book will not hurt anyone, and might be of some use in helping the men to solve some of their knotty questions. If anyone wants to buy it, and has the money to pay, my publishers stand ready to meet the demand.

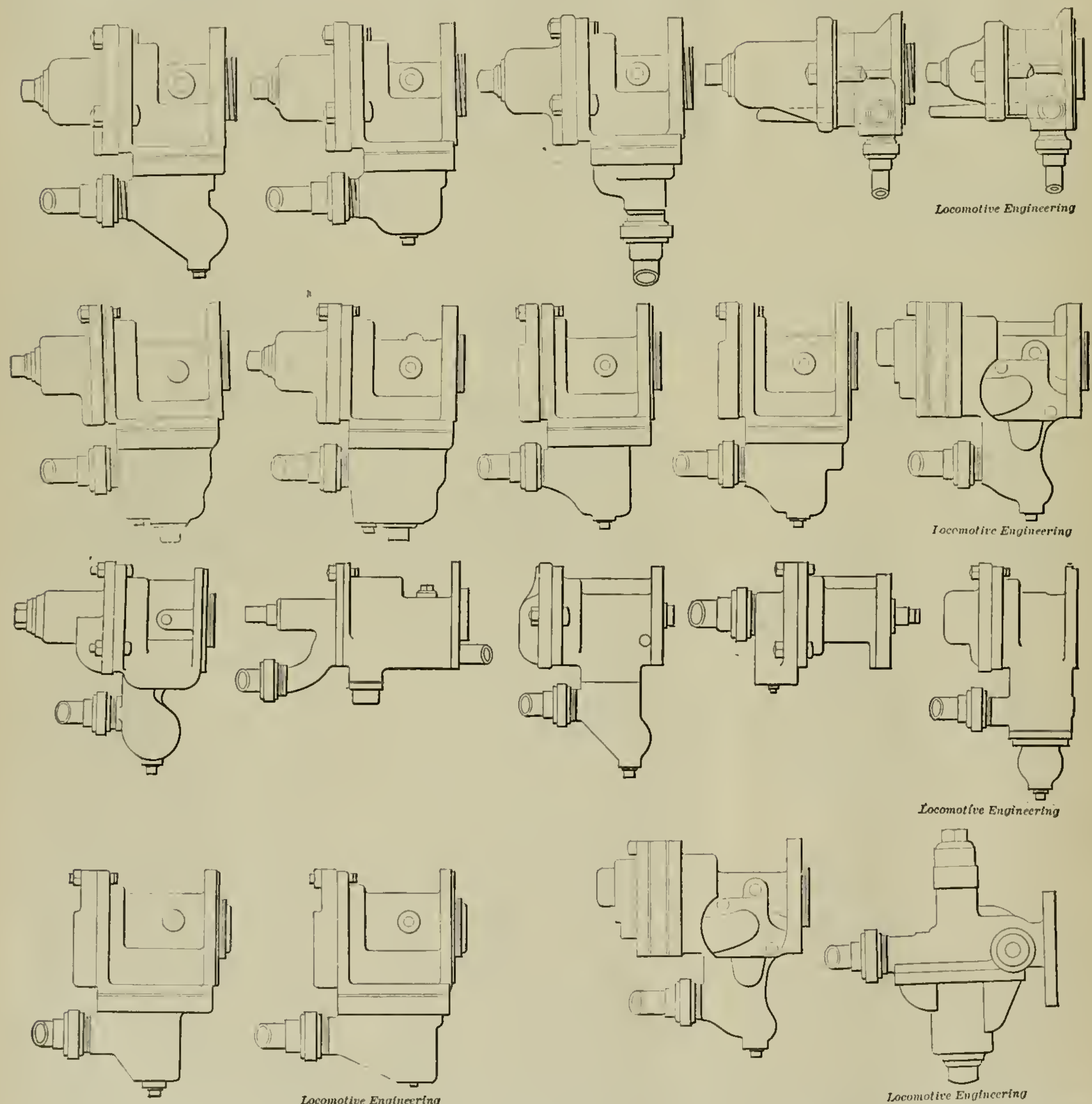
I wish it understood, however, that it is not to be inferred from this that I am connected in any way, either directly or indirectly, with any engineman's correspondence school, or the air-brake department thereof, but am diligently striving to get at the inside mysteries of the patent law business.

If you will kindly put this somewhere where it will attract the gaze of my friends amongst the readers of your air-brake columns, you will very greatly oblige,

Yours sincerely,

PAUL SYNNESTVEDT.

Chicago, Ill.



AIR-BRAKE INSPECTOR'S IDENTIFICATION SHEET, SHOWING THE ACTUAL NUMBER OF DIFFERENT TYPES OF TRIPLE VALVES NOW USED.

Retaining Pressure in Driver Brake Cylinders.

Editors:

In the April number I notice a communication from H. C. Fraser in regard to braking long freight trains and the device he mentions for preventing the train from breaking in two when releasing prior to making final stop at a station.

Twelve or thirteen years ago I was using an engine on which the driver and tender brakes were both operated by one triple valve and auxiliary, it being under the tender. The pipe to the driver brake came up by the boiler-head in a loop with a stop-cock in it, and I used frequently to retain the pressure in the driver brakes by shutting the stop-cock when the brakes were applied. Later I had a pipe and stop-cock attached to the triple valve as mentioned by Mr. Fraser, and by using it as he speaks of I could almost always stop my train so as to have the engine at the water tank or the way-car in front of the freight-house door, without breaking any couplings or damaging draft rigging.

Mr. Fraser rode with me on different occasions, and approved of it, although I don't claim I am the first to have used it. Our limit in size of trains then was 45 loads, or loads and empties not to exceed 55 cars.

Another engineer took this engine up onto the mountain division some time later, and nearly ruined a set of tender wheels by trying to run with the stop-cock closed all the while in coming down-hill. It was therefore taken off the engine, and I have seen no more applied.

O. J. McKay,
Southern Pacific Ry.

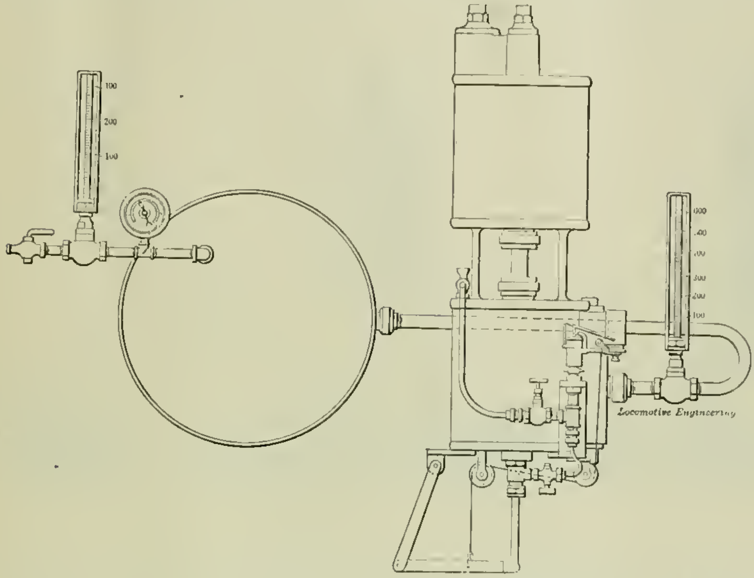
Rocklin, Cal.

Saving Air in Coupling Up.

Editors:

I would like to have question 35, page 161, March number Locomotive Engineering, more fully discussed, and I here give my reasons for thinking J. H. B. practices a saving of air by applying brakes lightly on head section before cocks are opened between two sections.

Suppose J. H. B. to have a train of twenty cars, all equipped with quick-acting triple valves, train line and auxiliaries equalized at 70 pounds. While running along ten cars break off, and when coupling up train again he applies brakes lightly on head section before angle cock is opened into rear section. Say he makes a 5-pound reduction at brake valve. This means a reduction of 5 pounds on each



TESTING APPARATUS USED BY THE AIR-BRAKE ASSOCIATION COMMITTEE ON D., L. & W. RAILWAY AT SCRANTON, PA.

car of head section. Now when trainman cuts head section into rear section he can only get a full service application, which means 50 pounds on brake pistons.

Suppose, again, that J. H. B. makes no reduction, intending to save that much air for releasing the brakes on his train. Now as trainman sets brakes on head section when he opens angle cocks between two sections (and as has been my experience to see trainmen open angle cocks suddenly), causing brakes to go on with full force, in this case we get 60 pounds on brake piston. Now, as the pressure that enters the brake cylinders is all lost when brakes are released, there would be a loss of 60 pounds on each car of head section.

If J. H. B. makes a reduction of 5 pounds at the brake valve, that is 5 pounds gone to the atmosphere instead of going back into his train line. But as this reduction brings triple pistons out against graduating stems, trainmen can only get a full service application, which means 50 pounds on brake piston. This 50 pounds in brake cylinder and a 5-pound reduction at brake valve would be a loss of 55 pounds. In this way J. H. B. makes a saving of 5 pounds on each train of ten cars. Will someone please show me my mistake?

Dan O'Brien.

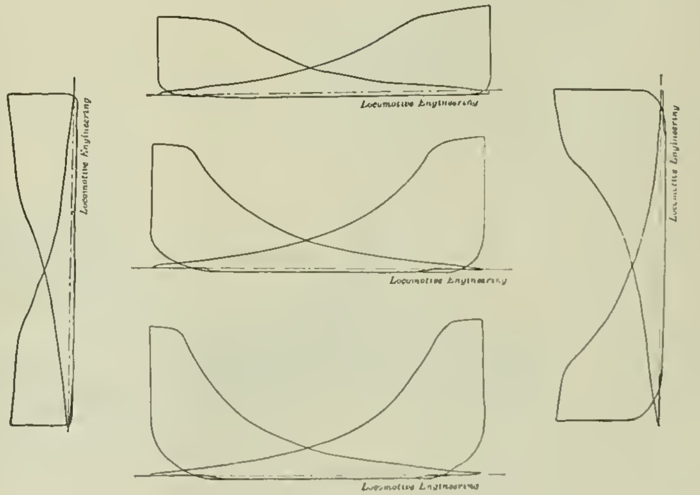
Venice, Ill.

[Mr. O'Brien evidently desires to have some discussion on the question. We will therefore postpone our criticism until next month, and thus give our readers an opportunity to discuss it. Correspondents will please send in their comments early.—Ed.]

"New Location for Main Reservoir."

Editors:

Under the above caption Mr. A. L. Beardsley writes in a late issue of Locomotive Engineering, and advocates



A SAMPLE OF AIR-PUMP INDICATOR CARDS TAKEN BY THE AIR-BRAKE ASSOCIATION COMMITTEE ON PUMP TESTS.

placing main reservoir on top of boiler, and since seeing cut of N. C. & O. engine in April number, with reservoir so located, I think enginemen will agree that it detracts considerably from the looks and symmetry of the locomotive.

Nor do I favor the location suggested by Mr. M. T. Jukes in October number for the same reason; besides, engines having front-end extensions, it cannot be so placed.

Any location upon the engine is bound to be either in the way, look out of harmony, or be placed where it can hardly be got at for repairs or drainage purposes.

The worst of all locations is the one behind the firebox, under the deck, for besides being in the way and hard to get at, it creates a current of air, filling back driving boxes with dirt, and keeps a cloud of dust circulating in the cab, to the great discomfort of the enginemen.

The location I think will come nearer being the right one is the one suggested by Mr. Geo. E. Rhoads, in May number, 1896, LOCOMOTIVE ENGINEERING. Here we have a location that is easy to get at for drainage and repairs. It is in perfect symmetry with cistern, but, best of all, any size or capacity can be had. The objection to this location must be that an extra line of pipe and hose is necessary, and that it lessens the capacity of cistern by a few gallons of water, but the advantages surely offset this.

At the time Mr. Rhoads sent his blueprint of this location, he also asked for your opinion, but you failed to give it. I would like to see your comment, also that of others, on this location.

H. THORNBURY,
Paducah, Ky. N. C. & St. L. R. R.

[Objections can be raised by someone to any location named. The position favored by one will be opposed by others. Personally, we believe the better location, when the build of engine will permit it, is that one between the frames back of the cylinder saddle. Frequently two smaller reservoirs may be used here, when one large one could not.—Ed.]

Machine for Fitting Up Air-Brake Hose.

Editors:

With our rapidly increasing number of air brakes in freight service comes a corresponding increase of expenditure to maintain the same; hence any device that can be shown to reduce the cost of such maintenance should be in demand. Air-brake hose forms no small part of this expenditure. Not only is this shown by manufacturers' invoices, but the cost of fitting up the same is considerable, especially where the work is done by hand.

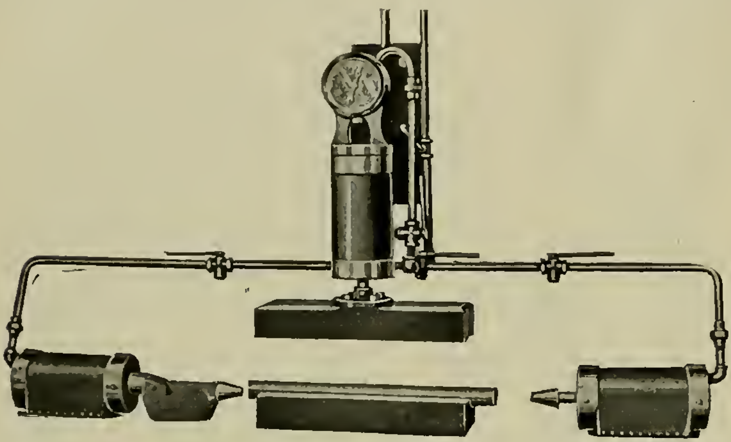


Fig. 1. MACHINE USED BY SOUTHERN RAILWAY FOR FITTING UP HOSE.

This is not especially true where the parts to be so fitted are new, but very little new material is used in repairs. From time to time cuts and descriptions of appliances for such work have come out in various mechanical papers, and I herewith add another to the list.

The idea was not altogether original with the Southern, but was re-designed by our general foreman and master mechanic at Atlanta, Ga., and so successful was its operation that it became a standard on the Southern, and is now in use in all of our principal shops. It consists of three 5-inch cylinders, two horizontal and one vertical. The vertical cylinder, by means of two grooved blocks, is used for confining the hose during the process of fitting. The two horizontal cylinders have each an expanding plunger which "bells" the hose ends for admission of coupling and nipple; after which operation the expander on the left is raised to a vertical position, and a coupling is placed in the head for insertion, while the expander on the right drives in the nipple. The vertical cylinder is also used for forcing together hose clamps preparatory to bolting. Each cylinder is operated separately by means of a three-way cock conveniently located. These various operations described above can be readily understood by referring to illustrations Nos. 1, 2, 3 and 4.

W. F. BRODNAX,
Genl. A. B. Insp., Southern Ry.
Richmond, Va.

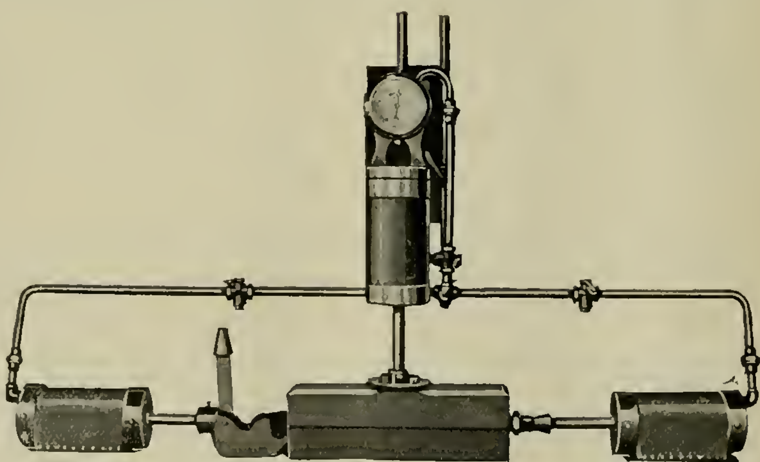


Fig. 2. MACHINE FOR FITTING UP HOSE ON SOUTHERN RAILWAY.

The Air Brake Instructor.

Editors:

The importance of the air-brake instructor and the responsibility which falls on him is so little thought of that the subject is well worthy of consideration. This is especially true at this time when so many roads are considering the appointment of one, and so many "would be's" are springing up.

The question, "Does it pay to have one?" is the most pertinent one to the management of a road. If the instructor is a good one, and receives the proper support, it most assuredly does pay, even if he receives a salary as large as the S. M. P. But good results cannot be expected from even the best man, unless he receives the support of the officials over him. On the other hand, a poor man is worse than none at all.

The appointment is worthy of the most serious consideration, and, in some instances, is receiving it. I was informed by one of the most prominent superintendents of motive power, not long since, that he has been looking around for over a year for a suitable man, and as soon as he finds him he will make the appointment.

As to wherein this appointment pays a railroad, the saving is made in small details that escape the eye of a master mechanic for the reason that he has so many larger matters to look after. As an example of what I mean, I know of a case where a new Plate F-6, or 1892, brake valve was condemned and thrown in the scrap-heap because someone had removed the feed-valve piston. In another case a number of Plate D-8 brake valves were thrown away because the man who attempted repairing them could not get the rotary valves tight by grinding with coarse emery. Every air-brake man has doubtless encountered a number of similar cases.

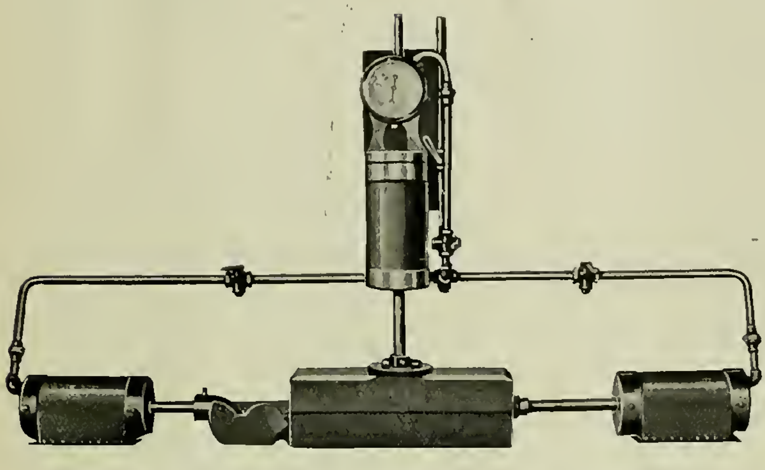


Fig. 3. MACHINE FOR FITTING UP HOSE ON SOUTHERN RAILWAY.

I have made reference to the responsibility which falls on the air-brake instructor. A little thought will readily show what I mean. Suppose, for example, the instructor tells the engineer to throw to release before going to the emergency position (such instructions have been given), and the engineer in turn attempts to follow his instructions when he gets in close quarters, the cost of the result would almost pay a good instructor's salary for life. There are many just such cases that could be cited if need be.

It may be urged against the appointment of an instructor, that the traveling engineer can attend to the air-brake part as well as his own duties. I do not desire to cast any reflections on the traveling engineers, for many of them are among the brightest air-brake men; but if the traveling engineer attempts to attend to the air-brake work on any but a small road, something is going to be slighted. Either he will become an "air-brake crank" and let his original duties go, or else he will let the air-brake work go and attend strictly to his original duties. Traveling engineers are but human, and when they have to keep the engine out of the shop as long as possible, see that the full capacity of the engine is made use of, and running time made, and keep the oil and fuel account to as low a point as possible, they have all they can attend to, and more in some cases. To expect them to take care of the air-brake work in addition, is urging them to superhuman efforts which are bound to result either in one being entirely neglected, or neither one being done properly.

As to what qualifications a good air-brake instructor must possess, he must above all be practical. By practical I do not mean simply having worked in the shop. I mean that he must be able to do what he is instructing others to do. He should have shop experience enough to enable him to go into the shop and show the repair men how to overhaul triples, brake valves, etc.; he should have road experience enough to render him capable of handling a train; not necessarily to make accurate stops with one application every time, for only familiarity with the stations and trains will enable him to do that. But he should be familiar enough with handling trains to take the engine anywhere and show the engineer the idea he is trying to convey.

Next, and greatest of all, he must not have an attack of that brain disease generally known as the "big head." Engineers and firemen will discover symptoms of this sooner than a physician, and unless a radical change occurs, the instructor had better be removed, as his day of usefulness is past.

Good grammar and easy flow of language are not requisites, for some of the very best instructors butcher the Queen's English most horribly. True, they do not loom up as well on "dress parade," but they instruct. The instruction should be given in language that can be understood by the one instructed, and not solely by the instructor.

As regards instruction: What instruction should be given must be determined for each man individually and independently of the rest. The construction of the different valves and the pump, while of interest to all and almost vital to some, if depended on to make the stops smoother and emergency applications less frequent, will fail lamentably in a large number of cases. Sing-song recitations are of no avail; the instruction should be made interesting both to the instructor and pupil, for the moment the instructor loses interest the pupil does also. The engineer should receive sufficient instruction on the construction of the brake to enable him to understand its operation; the rest of the instruction should be on road work. The instruction for train crews should be very similar, leaving out the brake apparatus on the engine, except for advanced students. The shop men should be instructed in construction and locating defects, as well as the proper method of repairing. The car men should have instruction in the construction of car brakes, testing, locating defects, cleaning and oiling, etc. The latter can be done better by example than by a week's talk

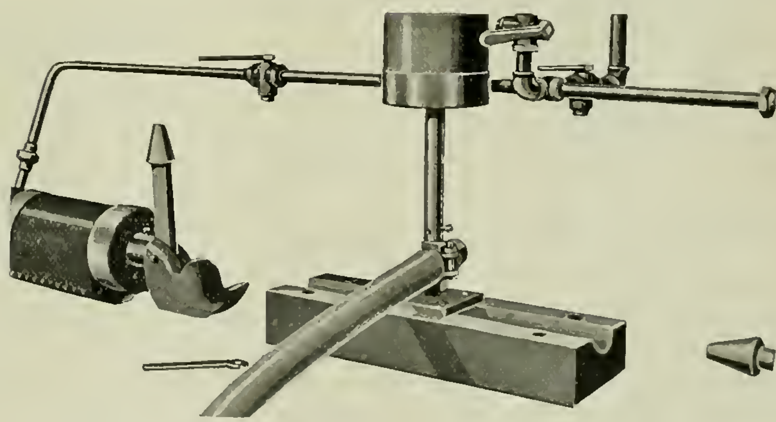


Fig. 4. HOSE CLAMPING MACHINE USED ON THE SOUTHERN RAILWAY.

Last, though one of the most important, the instructor should have the support of every official from the foreman to the general manager, for without this all his qualifications and efforts are for naught. I do not mean that he is to be given *carte blanche* by any means. Let him report to the superintendent of motive power or general master mechanic, and consult with him before taking any radical measures; but if he issues any instructions, let his officials assist him, by their influence, in enforcing them. Let them not revoke his instructions, or cast any disparagement on them, if a car inspector, shop man or engineer who does not fully comprehend them complains that they are "no good." Instead, let them call the instructor up, inquire closely as to his reasons for issuing the instructions, and if they are insufficient have him revoke the instructions.

A word as to the scarcity of air-brake men and I am done: There are hundreds of young engineers throughout the country to-day who, with a little encouragement, would make ideal air-brake instructors, or inspectors, whichever term is preferable. For repair men there are thousands of bright apprentice boys that will make better repair men, with proper instruction, than the older men. The car department is the worst off, in view of the freight equipment that will soon have to be cared for, but careful selection will produce satisfactory results even there.

Robert Burgess.

Red Bluff, Cal.

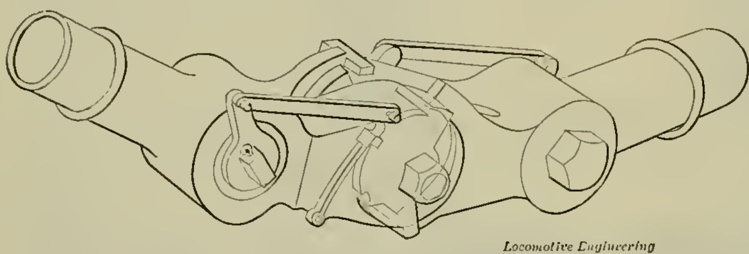
A New Hose Coupling.

Editors:

I send you herewith a drawing and description of our patent hose coupling device. The operation of the device can be briefly summed up as follows:

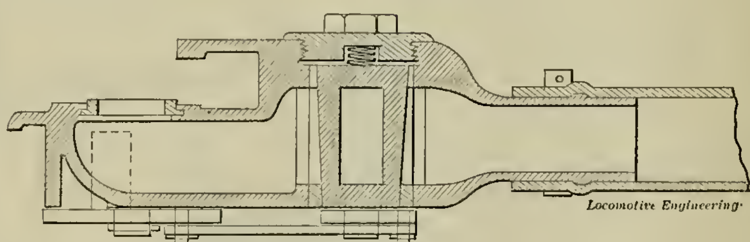
When the couplers are coupled, the operation of turning them upon each other to uncouple will cause the shoulder of one to engage the arm on the turn-plate of the other member, carrying the arm back with it and turning the upper part of the plate forward. This forward movement of the upper part of the plate draws the link and crank-arm with it and closes the valve of the angle-cock by the time the turn-plate has been turned around far enough to permit the two coupling members to uncouple. A like movement takes place in each coupler and the ends of both pipes are closed, thereby permitting the uncoupling operation to be performed with much greater ease. In the coupling operation a contrary movement will cause the shoulder to engage the arm and push it backward to open the angle-cock.

You will see that we have aimed to produce an improved automatic air coupling, so constructed as to make mistakes or tampering with the air line impossible. We believe our device to contain the following good features:



A NEW HOSE COUPLING.

1. It does away with the angle-cocks, and will not couple unless it is coupled right.
2. It will couple and work with any standard coupling now in use.
3. It gives the full air opening required to operate the Westinghouse quick-action brake, retarding the air no more than the coupling now in use.
4. It is cheap and durable, can be inspected from the outside, and does not rebound when cut.



SECTION OF A NEW HOSE COUPLING.

5. In case the train should part when in motion, the valves are so arranged as to remain open, thus releasing the air, and the brakes will be set.

W. & M. Cunningham.

Pittsburg, Pa.

Testing for Train Line Leaks.

Editors:

In reading over the pages of April number of Locomotive Engineering, I came to a brief pause upon the two articles of Messrs. Collom and Hammond, regarding Mr. Blackall's method of testing for train-line leaks. While these gentlemen's theory of testing, etc., is very good, still they seem to lose sight of the fact that Mr. Blackall's formula is very reliable, especially so by making a train-line reduction of 5 pounds or so, which will insure us against back leakage from auxiliary reservoirs into train line past the feed grooves in the triple. Consequently, whatever leakage takes place in train line now, this source of supply will be cut off from the auxiliaries. Therefore the leakage will show more quickly on the air gage with handle on lap position, and will show the almost true condition of the train line.

Again, as to the perfect condition of the packing rings in equalizing pistons, I have been unable to find a great many, either new or in service, for some time, that will not allow air to leak by them sufficiently to give us a clear idea of the condition of the train line. As a general rule, if 90 per cent. of our enginemen were asked how they would test their air-brake cars for train-line leaks, they would simply answer, "By moving handle over on lap and watch if the black pointer falls." And why? Simply because they have been instructed to do so.

Now, from a practical standpoint, it would be very well if Mr. Blackall's formula was added to this, and enginemen were instructed to make a few pounds reduction and lap the valve, then watch the pointer, which is the quickest and simplest method of testing before leaving a terminal. In so doing, it is safe to say that we will be on the right track for train-line leaks.

H. A. Flynn,
S. & W. Co.

Wilkes Barre, Pa.

It is reported that the new underground railway of London will use the Westinghouse quick-action automatic brake on its trains.

It appears that the specifications for air-brake hose gotten out by the Peerless Rubber Company are destined to produce a lasting benefit. One of the trunk lines has already adopted the code as a whole, another has modified it slightly, and other roads are testing the material in hose in one way or another, besides subjecting it to a pressure test.

If railroads paid more attention to getting good air hose, there would be fewer breaking-in-two of trains.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(55) M. C. G., Durham, N. C., asks:

1. What effect does it have on a bridge to make an application of brakes on the bridge? A.—1. There is a force produced which tends to push the rails in the direction the train is running. 2. What effect does it have on a bridge to make an application of brakes before reaching the bridge, and holding brakes on while the train is passing over the bridge? A.—2. Same as preceding answer.

(56) R. F., New Orleans, writes:

We have an engine that has both driver brakes and tender brake worked from one auxiliary reservoir under the tender. Can the driver brake be cut out by the three-way cut-out cock of the triple under the tender, and work only the tender brake? A.—You cannot cut out one without cutting out both. There should be another auxiliary reservoir added for the driver brake. The driver brake should always be worked along with the tender and other brakes.

(57) R. B., Washington, Ind., writes:

I am running an air compressor in the shops here. We have got a main pipe running from the air compressor to the main reservoir and a pipe running from there to the shops for the use of the air. When we are pumping into the reservoir it makes such a hammering noise in the reservoir that I would like to ask if I could overcome that noise. A.—The pound is doubtless caused by the discharge valve of the compressor seating, and might be overcome by making a valve with a larger area and less lift.

(58) R. F., New Orleans, La., writes:

1. With the D-5, or 1892, brake valve, when I release brakes, on a short train or light engine, the air will flash or blow out of the angle fitting or train pipe exhaust. Where does this air come from? A.—1. On account of the short length of train pipe, the space under the equalizing piston in the brake valve fills up more rapidly than the chamber on top of the piston, causing the piston to rise, and the air that is coming from the main reservoir to the train pipe escapes out at the angle fitting, making the blow or flash mentioned. 2. Is the angle fitting and train pipe exhaust the same thing on the brake valve? A.—2. Yes.

(59) R. F., New Orleans, La., writes:

1. We have an engine with the whistle signal on, but our coaches have no whistle signal. But the whistle will blow every time brakes are released. What is the trouble? A.—1. Dirt or gum is holding open the supply valve of the pressure-reducing valve, and every time brakes are released the air in the signal pipe flows back into the main reservoir. This reduction in the signal pipe caused the whistle to blow. Clean the supply valve and the trouble will disappear. 2. It also blows when engine strikes a low point. What is the trouble? A.—2. The diaphragm stem in the whistle valve needs cleaning. These two troubles usually go together.

(60) J. A., Boston, Mass., writes:

One of the engines coming into this roundhouse has an air brake on the engine truck. A few days ago we had to put in a new truck spring, and had to take down half of the truck brake to get at it. On the engines that don't have truck brakes I can do the job in an hour. On this engine with the truck brake it took four hours to change the spring. This is expensive work. Don't you think the truck brake is more trouble than it is worth? A.—No. On the contrary, we believe it is one of the most valuable appliances put on a modern locomotive. It may interfere with your changing springs once in two or three years, and cost the company a couple of hours more for the time of your helper and yourself, but the good service it gives on the road outbalances, by far, the little annoyances it gives once in a great while when springs have to be changed. See article on engine truck brakes elsewhere in this department.

(61) A. J., Boston, Mass., writes:

Some little discussion has been held here regarding the cam-brake leverage. As the driver-brake shoes wear, the cams go down nearer the rail and the angle of the cam stems change. The question is: Does the braking power change as the brake shoes wear. X says the power almost doubles if the piston travel increases 3 inches. Please explain. A.—If the cams are properly designed, there is little, if any, difference in braking power as piston travel increases. If the cams intended for one engine are used on another engine, the braking power will increase with increased piston travel, or may decrease, according to the particular kind of cam used. The cams are so designed that the point of contact between the faces of the cams remains a fixed distance above the top of the rail, regardless of how near the cams approach the rail. In other words, the point of contact shifts and moves upward on the face of the cams as the cams come down, and the braking power remains nearly constant.

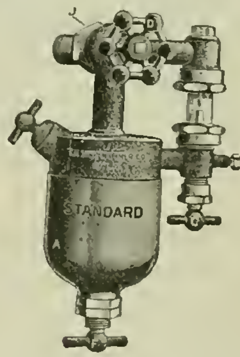
(62) A. A. H., Marshalltown, Iowa, writes:

Instruction books treating on air brakes state that when two or more engines are coupled to a train, all brake valves should be cut out except the one on leading engine. I do not know that I ever saw a reason given for it; but it occurs to me that it is done to allow leading engineer to reduce train pipe pressure, when he wishes to apply the brakes, which I do not think he could do if all the pumps were pumping into train pipe. Am I right? I do not think it is always so understood, as I heard an engineer remark that all pumps should pump into the train pipe. A.—The brake valves on all but leading engine are cut out so that the leading engine may do the braking without interruption, as you state. One engineer pumping into the train pipe and another drawing out at the same time would interfere with the proper action of the brakes. It is for this reason that instructions are given to let the head man do the braking and make him responsible. On some roads, however, it is the practice to let the head man do the braking, and at a prearranged signal, the second engineer will assist in recharging. Unless great care is exercised, this plan is dangerous, and for that reason is not recommended for general practice.

A systematic record of the condition of air brakes on freight cars passing over the N. C. & St. L. Railway has been kept at the two terminals, Nashville and Atlanta, and the somewhat startling knowledge has been gained that of the entire number of inoperative air brakes cut out in five weeks, 41 per cent. were on private line cars.

Boiler Oil Injectors.

The use of oil in boilers for preventing scale, pitting and sundry evils, has become such a common practice that two injectors, especially for this purpose, have been put on the market by The Lunkenheimer Company, of Cincinnati, O., a cut of the "Standard" being shown with this.



It has but one connection, but has a visible oil-drop feed, so that the exact feed can be determined. They are made in several sizes, varying from half pint to two gallons, and seem to be giving satisfaction where used.

A conference was held between representatives of the Locomotive Engineers' Brotherhood and the officials of the Union Pacific last month, to settle on a scale of wages. After a session that lasted for several weeks, a new wage schedule was adopted, which is reported to be satisfactory on both sides. The terms of this agreement are likely to be claimed for other roads.

WHAT YOU WANT TO KNOW.

Questions and Answers.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(44) W. B. M., Columbia, Pa., asks about the meaning of positive and negative lead. A.—When the crank is on the dead center, which is the beginning of the stroke, the distance the valve edge has uncovered the admission port is called lead. A common amount of lead is 1-16 inch in full gear. Some engines have the valve set so that the steam port is entirely covered at the beginning of the stroke. The distance the edge of the valve laps over the port at that period is called by some people negative lead. We think the valve being set blind is the better expression.

(45) R. B. M., Philadelphia, writes:

I frequently see in LOCOMOTIVE ENGINEERING and other papers the expressions "slip," "slide" and "skid," as applied to locomotives or car wheels. Please let me know the meaning of the words when so used, for Webster says slide means to slip and slip means to slide. He treats skid as a noun, and I know that writers in the papers use it as a verb. A. —In railroad parlance, to slip the wheels is to make them turn on the rail without advancing, or advancing less than the movement of the wheel would measure; to slide is to block the wheels by pressure of brake-shoes or otherwise and permit them to move along the rail without turning; to skid is the same as to slide, and is generally used by British writers.

(46) R. E. H., Peru, Ind., writes:

1. We have a switch engine, which, after having a new pair of cylinders applied, handled so stiff as to make it impossible to use it on short switching. After several months of work the engine is working all right, and I want to know what you think about it. A.—1. The engine was no doubt suffering from too much "bind" in the valve and reversing gear. 2. I have taken several links from engines and, after heating the ends, put them in cold water to close them. How many times do you think a link would close this way in taking up the lost motion for the block? A.—2. Probably three or four times; but the practice is not one to be commended, for the reason that strains are set up in the link that make it weaker at each repetition.

(47) J. C. T., Washington, D. C., asks:

1. What is the limiting mileage of engine and truck axles, and how is a satisfactory record kept? A.—1. There is no standard system of rating the life of axles by mileage. It is the practice on some railroads to remove axles after having made a certain mileage, and on others to allow the wear of journals to govern the time of service. In the latter case, an axle removed for wear is generally placed under a lighter car and made run to another limit of wear. Records of life of axles by either systems are commonly kept by stamping in axle the date when put in service, and the date placed on file in the office. 2. What is the limiting mileage of cast-iron car wheels, and when is a wheel flange worn too much for safety? A.—2. See Rules of Interchange adopted by the Master Car Builders' Association.

(48) R. F. N., St. Paul, asks:

1. What is the cost of a 33-inch tire to a railroad company at St. Paul? A.—1. Five cents a pound. 2. Why can the feed on a wheel lathe be increased by steadying the wheels with the jacks shown on page 144 of the March issue? Would it not answer the same purpose to have the jacks placed between the wheels near the rims? A.—2. The feed can be increased for the reason that the jacks hold the wheels more rigidly against the cut than is the case when the wheels are simply driven without such support. In other words, the lathe is made stiffer by the use of the jacks, because they effectually prevent torsion in the axle. Jacks used between the wheels are not so effective for rigidity as those shown, for the reason that they do not resist the twisting effect on the axle of the cutting tool as well as shown in the cut.

(49) W. U. S., Little Rock, Ark., asks:

What is it that causes the driving wheels of a locomotive to slip, while running a high rate of speed, when steam is shut off? A.—The slip of wheels at high speed is due to the centrifugal force of the counterbalance in the wheels. This force is great enough in some cases to lift the wheel appreciably from the rail, as has been demonstrated at Purdue University. It is most noticeable in engines at speed when having heavy reciprocating parts, in which a large proportion of these weights are taken to counterbalance against. The effect of this counterbalance of the reciprocating parts (which are the piston, crosshead and from one-fourth to two-thirds of the weight of main rod) is to balance those parts while passing the centers. Such a balance is productive of a smooth-riding engine at slow speed; but at high speeds it becomes a disturbing element, as stated above.

(50) G. R. S., Joplin, Mo., asks:

1. Do you think that one pint of the best valve oil is sufficient to lubricate the valves of an 18 x 24 switch engine for twelve hours of hard work, where the engine is reversed a great deal to aid the brakes in making stops? Is it enough for a 17 x 24 engine under the same conditions, and is the same amount sufficient for a 19 x 26 road engine on local freight for ten hours or 100 miles, handling a heavy freight engine? A.—1. Yes. See Proceedings of Traveling Engineers' Association for 1896. 2. How long should the valves and cylinders of an 18 x 24 ten-wheeler be capable of running without refacing and reboring, assuming that the engine gets all the oil it needs? A.—2. We cannot say, without a knowledge of the material. The degree of hardness of the iron controls the wear. Cylinder iron should be as hard as can be worked, in order to wear well and give long service. 3. What is the average life of a set of Jerome or United States gland packing in locomotives doing freight work, in case it gets proper amount of oil and attention. A.—3. About 100,000 miles.

(51) E. H. B., Newark, N. J., asks:

What stresses or forces are the main and side rods of an 18 x 24 mogul subjected to, with a boiler pressure of 180 pounds? A.—The pressure on the piston is equal to

$$P = \frac{\pi d^2 p}{4},$$

in which d = diameter of the piston, and p = pressure on the piston. This pressure on the piston is found from the equation to equal 254.47 × 180 = 45,804 pounds, and is the force resisted by the main rod. The side rods each have a push or pull equal to

$$P^1 = \tfrac{1}{3}\,\frac{\pi d^2}{4} p,$$

that is, one-third of the force on the main rod, since the total force is distributed by means of the side rods equally among all the wheels. There are also stresses in the rods due to centrifugal force, in amount depending on the speed, in addition to those noted above. The subject of stresses in rods, and how to provide for them, will be treated in an article now in preparation, to appear in the July issue of this paper.

(52) J. E. M., Cleveland, O., asks:

1. How to make plaster of paris molds for soft metal packing rings for piston rods and valve stems. A.—1. We do not know. Metal molds are the usual practice. 2. What is the rule for figuring the angle of expansion of steam from the exhaust nozzle of a locomotive? A. —2. There is no reliable rule, except that of trial. 3. How does the Smith exhaust nozzle operate, and what are its advantages? A.—3. It ejects the steam through openings of large area, a central and annular one, for which less back pressure and a reduced fuel consumption is claimed. Write to General Agency Company, 168 Broadway, New York, and get cuts of the device, as well as particulars of its performance. 4. You published in 1889 a description of a boiler check which was placed on the wagon top of boiler and water was delivered into an open trough and carried to forward end of boiler. Can you give the name of the road this arrangement was in use on? A.—4. No. 5. As horizontal line check-

valves placed in ends of injectors will not stop flow of water and steam when the main or boiler check is stuck open, no matter if boiler check leaks but little or blows back hard, can you give any reason why these checks are placed in the injectors? A.—5. A horizontal line check should not be allowed to leak bad enough to impair its function as a check. If given proper care they will prevent steam from reaching the injector.

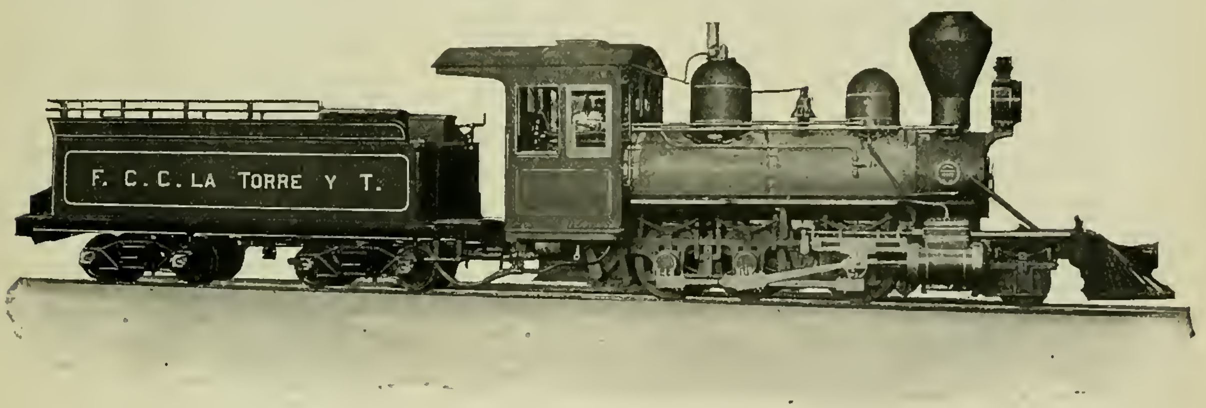
(53) E. H. Z., Chicago, Ill., asks about the Ashton safety valve as follows:

Why is the wing on the outside of the valve made to come within 1-64 inch from the flat surface of the valve seat? If this is to gage the number of pounds of steam the valve is to release, please state the proper distance the wing should be left from the flat surface for 2, 3 or 5 pounds reduction; also please state the object of the small holes in the top of the valve in the groove. Is there a certain number of holes required for the size of the valve, or does it make no difference how many holes there are, or what size they are? A.—These questions were referred to the Ashton Valve Company, who kindly reply: "Answering your question why the wing is made to come within 1-64 inch of the flat surface, will say that it is done for the reason that there is a lateral play to the wings and head of the valve which guides it in nearly a straight line, and if this clearance is not allowed, the wing, or what we call the lip, would strike on the flat surface of the seat and wear the lip down faster than we require. The relation of this lip to the seat is very essential; that is, it should never be more than 1-64 inch, for the reason that if it was, the steam would escape out under the lip as fast as it escaped into the increased area of the pop chamber, and there would be no benefit received from it. In other words, it is possible to take the pop all off the valve by having the lip too far from the seat. The present arrangement with the above mentioned clearance is such that as the seat wears, this lip or wing also wears, as in the seating of the valve the lip does strike with slight force on the flat surface of the valve seat, and by this means it is caused to wear as fast as the seat, and maintain the same relation between the seat and lip after months of service as when first applied. While this is virtually to gage the number of pounds of steam reduction, this relation of lip or wing and the flat seat should be the same for all pressures and all reductions of steam. The holes drilled through top of valve between the seat and lip are to decrease the amount of pop chamber. This pop chamber is the increased area exposed to the steam after it leaves the seat, which should be from lip to lip, but while it is on the seat it is simply on the area below the ground joint. To get less reduction of steam or pop, we drill holes through this increased area, which takes off part of the area, and the difference in number of holes in different valves is to compensate for the slight difference there might be in springs of the same size. If the valve does not relieve the boiler, and gives too light a pop, or flutters on its seat, it shows that there are too many holes through the pop chamber for the spring used, and if it is desired to use the same spring, it would be advisable to plug up some of the holes, thereby increasing area of the pop chamber."

Small Narrow Gage Locomotive.

The annexed engraving shows a mogul locomotive recently built by the Baldwin Locomotive Works for the Cazadero & Tepetong Railroad of Mexico. The gage is only 2 feet, and considerable ingenuity has been displayed in arranging the working parts of the engine conveniently. For such a small gage the engine is of considerable weight, having 35,000 pounds on drivers and 6,000 pounds in the engine truck.

As will be seen from the engraving, the frames have been placed outside the wheels and separate cranks used for the side rods. This makes a very convenient arrangement for an engine with small spread between the wheels. The cylinders are 11¾ x 16 inches, and the driving wheels are 33 inches outside diameter. The boiler is straight, 36 inches in diameter and provides 408.4 square feet of heating surface. The material used is first class in every respect, and closely adheres to what is used for first class railroads in the United States.



BALDWIN NARROW GAGE ENGINE.

"Wonderland" is the name of an annual magazine published by the Northern Pacific passenger department, to tell people looking for health resorts and recreation where wonderfully attractive scenes are to be found. There are 103 pages of the magazine, almost every one being profusely illustrated with half-tone cuts showing diversity of scenery sufficient for the most fastidious searchers for the beautiful in nature. The scenes shown are so numerous, and the narratives about the places are so diverse, that we cannot attempt going into particulars. We advise our readers to write to Mr. Chas. S. Fee, G. P. A. Northern Pacific Railway, St. Paul, Minn, and enclose six cents in postage stamps, for which they will receive a copy of this beautiful magazine.

The 1½-inch steam pipe for heating the coaches of the Wisconsin Central is carried in the interior of the car, passing through on under side of the clear story sill, and covered by a moulding so as to be invisible to the passengers. The same pipe on sleeping cars is carried on the roof, next to the clear story.

The railroad editor of the *Pittsburgh Post* has been honored with giving the name of "Continental Limited" to a new flyer on the Wabash.

If you need any book to help you to pass an examination, send for our "Book of Books."

How to Put on a New Boiler, Fit Up Spring Hangers, Driving Saddles, Etc.

BY IRA A. MOORE.

When the necessity arises for changing the boiler on a locomotive, the engine will have to be completely stripped, the wheels and truck taken out and the back frames taken down. If the shop is not provided with a crane sufficiently strong to lift the boiler, temporary trucks will have to be put under it, so that it can be run out of the way.

A truck should be put under the mud-ring and another just back of cylinder saddle.

Before loosening the boiler from cylinder saddle, the distance between front of water leg and back of cylinder saddle should be taken on a strip of wood, then

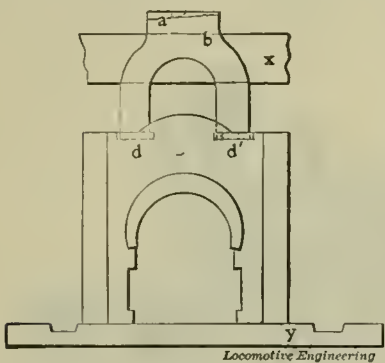


Fig. 14

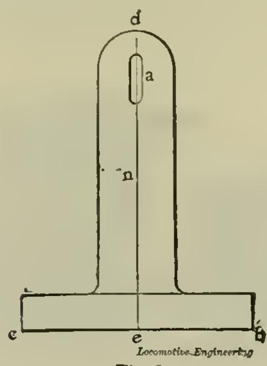


Fig. 15

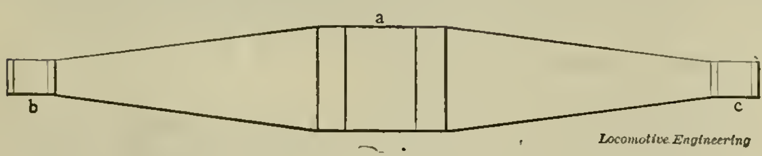


Fig. 16

by using the strip it is easy to get the proper distance between these two points when the new boiler is being put in place.

Possibly the new boiler is not at hand, and in the meantime let us turn our attention to some other parts of the work. The pedestal binders can now be fitted up in the manner described on page 186 of the April number of LOCOMOTIVE ENGINEERING. The work on the driving shoes and wedges can also be done while the frames are down, if a starting point is obtained before loosening them from the discarded boiler. This point is the point *x*, Fig. 3, page 80, February number, and is found in the manner there described. Before loosening the frames from boiler, the distance from outside to outside of frames at pedestal jaws should also be taken on a stick. The purpose of this strip of wood is the same as that shown in Fig. 7, page 81 of February number.

After fitting the pedestal binders set the frames on blocks on the floor in the same position that they occupy when on the engine, except the distance between them need not be the same, they may be any convenient distance apart—say, 2 or 2½ feet.

If a line had been drawn through the points *x* mentioned above, before frames were taken down, it would have been at right angles to the center of cylinders, and also at right angles to the frames. Therefore the frames must be set on the blocks so that a line through these points will be at right angles to the frames. To determine when they are in this position, put a straight-edge across the top of frames and set it so that it will coincide with a line drawn through *x* and at right angles to top of frame.

Now, by using a large square, determine whether or not the straight-edge is at right angles to the frame. If not, one of the frames can be moved back or forward, as the case may be, being careful to keep the frames parallel with each other. After they once have the right position they can be kept from moving by binding them together with strips of wood. The frames can now be laid out, and shoes and wedges fitted up as described in February number.

Now is a convenient time to "square up" the driving saddles. The first step is to ascertain whether they are worn enough to make them too short. The legs of the saddles should be long enough to reach from top of frame to bottom of pockets in the top of driving boxes, when the boxes are down on pedestal binders, as shown in Fig. 14. Suppose the distance between the frame *x* and pedestal binder *y* to be 17 inches and distance through frame 4 inches, making 21 inches; hence the distance between the dotted line *b* and top of pedestal binder is 21 inches. Now if the length of the box minus the depth of the pockets *d d'* is 13½ inches, then the length of the legs of saddle should be 21 — 13½ = 7½ inches.

While this is the proper length of the saddle legs, yet should they be found to be not more than ½ inch shorter than this, they may be used again. The bottom of the pocket in the saddle will generally be worn more on one side than the other, as shown by the dotted line *a*, Fig. 14. When the bottom of pocket is squared up at right angles to the side of saddle, if it is deeper than the thickness of band on the spring minus ⅛ inch, a plate of iron thick enough to bring it back to its original depth should be fitted into it. Now put a parallel piece of iron whose thickness is slightly more than the depth of pocket, and whose other dimensions are nearly equal to those of the pocket, into it, then turn the saddle up side down on a face plate. With a surface gage scribe lines across the legs, making the distance between them and the line *b*, Fig. 14. equal to the length of the shortest leg in the set of saddles.

Proceed in the same manner with the other saddles, then when the legs are chipped and filed to these lines, they will all be the same length, and their ends will lie in a plane at right angles to the saddle and to the bottom of pocket.

The equalizer stands will also need some attention. If the slot for the gib is not too much worn, the blacksmith can bring it back to the original size. Sometimes a new top welded on will make them all right.

Perhaps a new stand is necessary. If so, before laying out the bolt holes, the face *c b* should be planed at right angles to the top of stand, Fig. 15.

Scribe the line *d e*, Fig. 15, through the center of the slot *a* and at right angles to *c b*; also a line on side of frame, midway between centers of pedestals and at right angles to top of frame. Then set the stand on frame so that the line *d e* and the line on frame will coincide, then lay out the bolt holes with a scratch-awl through the holes in frame.

Care should be taken to have the gib slot far enough from the base of stand to allow enough clearance between bottom of equalizer and the bolt heads to prevent them coming in contact when the engine is running over rough track; ⅝ inch is usually enough. The equalizers very likely will be worn where the spring hanger and the equalizer stand gibs come in contact with them. The part *a*, Fig. 16, should be finished at right angles to the slot through which the stand passes, and then *b* and *c* parallel with *a*. A plate of steel about ⅜ inch thick should be put between the equalizer and the stand gib to prevent the gib cutting into the equalizer. When the plate wears, it is very easy to replace it with a new one. These plates can be made from broken leaves of driving springs. To determine when *b* and *c*, Fig. 16, are parallel with *a*, put the equalizer up side down in a vise, then put a straight-edge across it at *a* and another at *b* or *c*. Then by looking across them they will show which side of *b* or *c* must be filed to make it parallel with *a*. If it is *b* that is finished first, then put a straight-edge across at *b* and make *c* parallel with it, as described above.

The spring gear is now all fitted up, except the hangers. They should be the right length to hold the springs and also the equalizers parallel with top of frame when the driving saddles are resting on frame. Hence before they can be fitted up their proper length must be found, which can be done in the following manner:

Put the driving saddles and springs on the frame in their proper positions, also the equalizers and stands. Put the stand gibs in place. Set the equalizers so that a line through *b* and *c*, Fig. 16, will be parallel with top of frame and as high as the gibs will allow them to go. Set the springs with the gib bearings on each one will be the same distance from top of frame. Now the distance between the gib bearing on equalizer and on the spring, minus the draw, is the proper length of hanger, which length is the distance between the gibs. The draw should be from ⅞ to 1¼ inches, depending on the weight to be carried by, and the strength of the spring. The heavier the spring the less the draw required, and the heavier the engine the more draw necessary.

If the hangers as they were taken off the engine are not the right length, the blacksmith can change them to suit, and also close the slots if that is necessary.

The front frame fastenings should be carefully examined. We will now get the cylinder saddle ready for the boiler.

The cylinders should be blocked up perfectly level both ways.

The blocks can be put between the cylinders, letting the bottom of saddle rest on them. It will be necessary to have some thin strips of wood at hand to put under wherever required to level them.

Since the front frames have not been taken down, it is well to support their back ends in some way, preferably with screw jacks. Remove all scale and dirt from top of saddle. Now run the new boiler ahead until the distance between the back of saddle and front of water leg is the same as with the old boiler, as determined by the strip of wood mentioned above. The boiler should be blocked on trucks the same as the old one was for running out of the way. Now let front end of boiler down nearly to saddle. This can be done by means of a jack under the front end. Then set front end central between cylinders in the following manner:

Put a line over boiler just back of cylinders, letting the ends to which small weights have been attached, come below the frames, as shown at *a a'*, in Fig. 18.

If the boiler is central the distance between line and frame will be the same on each side. If the boiler needs throwing to one side, it can be done by setting the jack at a slight angle, letting the top stand away from the side to which it is desired to throw the boiler; then when the weight is put on the jack, it will right itself and throw the boiler over.

We will next plumb the back end. Put lines over the wagon top at *l* and *m*, Fig. 17, letting them extend below the mud-ring. When the boiler is vertical the distance from the lines to the boiler will be the same at all four corners. If the boiler is not plumb, the distance between lines and boiler will be greatest on the low side.

On account of the sides of water leg not being parallel with each other, or with the center line of boiler, it sometimes happens that the distance from the lines to boiler cannot be made the same at the four corners. In such cases the distances should be averaged up.

The boiler must be level lengthwise. This is sometimes determined by putting a level on top of the dome, but this is not reliable. A better way is to caliper the boiler at *a* and at *b*, Fig. 17. Suppose the boiler is 50 inches in diameter at *a* and 49 inches at *b*, then the distance from center to circumference is ½ inch more at *a* than at *b*. Now, if one end of a long straight-edge be put on the parallel piece *d*, and the other end on *c*, which is ½ inch thicker than *d*, the straight-edge will be parallel with center of boiler. Put the level on top of the straight-edge when

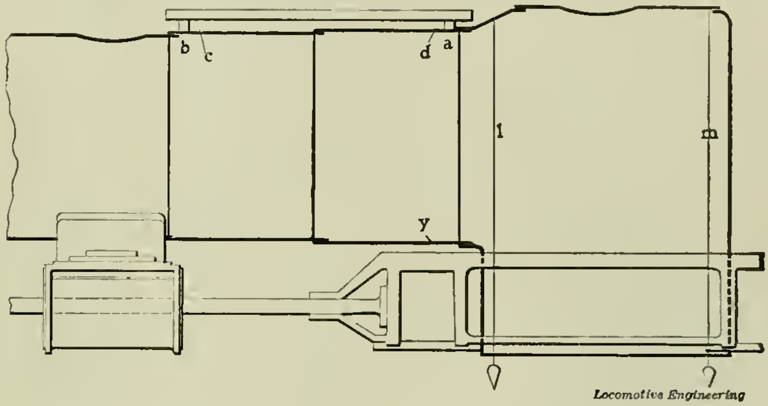


Fig. 17

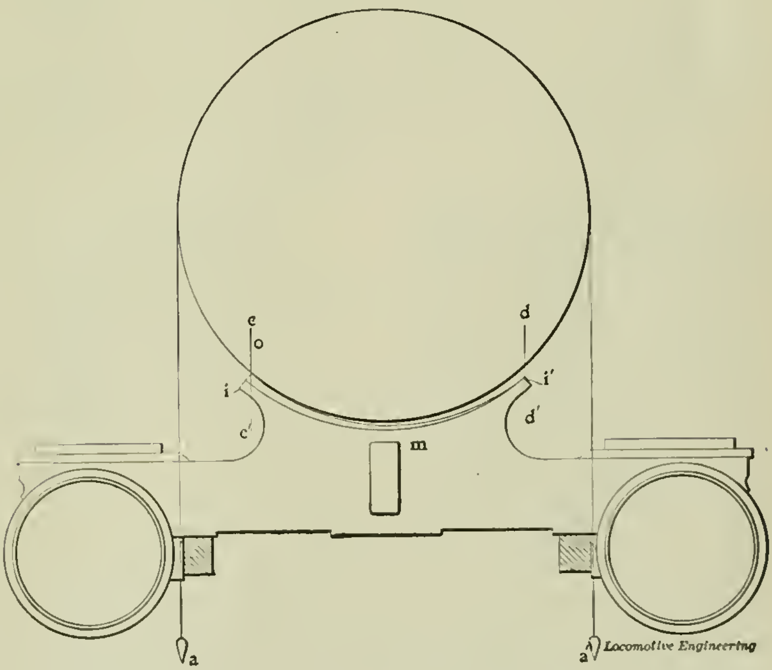


Fig. 18

leveling the boiler. Set the boiler level and parallel with the centers of cylinders, and at the same time have the smoke arch just touch the cylinder saddle.

To get the boiler parallel with cylinders, run lines through them and extending to the back end of boiler, and set boiler central between them by measuring from lines to water leg at the four corners.

If, on account of water leg not being parallel with center line of boiler, the distance cannot be made the same at the four places, it should be averaged up.

Since adjusting one end of boiler will throw the other slightly out of place, each end should be tried two or three times. We now have the boiler parallel with the cylinders and the smoke-arch touching the cylinder saddle at, it may be, only one corner, as shown at *o*, Fig. 18.

Now the arch must be fitted into the saddle, and it is necessary to have a line on the back and one on the front of saddle to work to. We will now proceed to get these lines.

First, measure the vertical distance between smoke-arch and saddle at the place

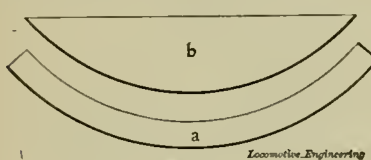


Fig. 19

where they are farthest apart, either back or front; then on the vertical lines *c c'* and *d d'*, Fig. 18, lay off this distance *i i'* at the four corners of the saddle. Raise the front end of boiler enough to clear the saddle, and run it back out of the way, being careful to first mark it, so that it can be run ahead to the same place again.

Make a wooden template, *a*, Fig. 19, to fit the curve of the smoke-arch at the front, and one at the back of saddle, and have them a little longer than the width of saddle. Now by means of the templates draw the curved lines *m* through the points *i i'* on both front and back of saddle. Chip the saddle to these lines and make it straight lengthwise by using a straight-edge. A better fit will be obtained if another pair of templates like *b*, Fig. 19, are made to fit the ones used to lay out the saddle; the convex edge being fitted to the concave edge of *a*. Then by using red lead on the edge of template the high places on saddle can be at once detected. On account of any irregularity that may be in the curve of the bottom of smoke-arch, it is well to have the templates, Fig. 19, marked in some way; then, when using them, be careful not to turn them end for end. Now run the boiler ahead again, and let the front end down on the saddle, when it will be as much lower than the back end as was taken out of the saddle. Hence the back end will have to be let down enough to level the boiler again.

Lines should again be run through the cylinders, and measurements taken from them to the boiler, as described above, to ascertain whether the work on saddle has been correctly done.

Suppose it is found that the line on left side is ½ inch farther from the boiler than the other one; then to bring the cylinders in line with the boiler about 1-32 inch would have to be taken off the left back and the right front corners of cylinder saddle. The bolt holes can now be drilled in smoke arch, preferably by using a twist drill through the holes in saddle, the drill to be same size as holes. If the holes cannot be drilled in this way, they will have to be laid out and the boiler run back in order to get at them. After drilling run the boiler ahead again, ream the holes and put in bolts.

We are now ready to put up and line the frames. Except the manner of finding the hight of frames, this can be done as described on page 186 of the April number of LOCOMOTIVE ENGINEERING. Since the frames are parallel with the cylinders and the cylinders have been set level, the frames must also be level. A very good way to level them is to level one of them lengthwise first—say, the left one—then put straight-edges across them at *x* and *y*, Fig. 17, and raise or lower the right one enough to bring the straight-edges level, which will give the frames the same hight.

Cedar Rapids, Iowa.

Maine Central Shops.

The shops of the Maine Central at Waterville, Me., are as nicely equipped for work as any of the older plants in the East, but are somewhat restricted for room, having been built when the road was younger and smaller than it is now. Barring the crowded condition, these shops are well to the front in up-to-date ways of handling work.

Considerable attention has been devoted to the question of test pressure for boilers. The water and steam pipes used for boiler purposes are carried on the chords of the roof truss, and pass down the posts at the sides of the pits, water on one side and steam on the other. By this convenient arrangement of piping, boilers are tested with an injector to a pressure 20 per cent. in excess of the rated boiler pressure, 70 pounds of steam on the pipe line giving 220 pounds pressure from the injector.

Mr. Ellis, the master mechanic, has got up some single-cylinder oscillating air engines for use about the shops, that are a handy little machine for boring cylinders, or running a tool at night. The cylinder is 5 inches diameter and 6 inches stroke. The valve of the engine is simply the reversing piston of an 8-inch Westinghouse air pump, and has the important advantage of making the engine run in either direction it happens to be started in. The engine is mounted on a four-wheeled truck. Mr. Ellis is one of the happiest combinations of originality and resource following railroading to-day, standing as he does with his experience of forty-five years, and coupling those years with the improvements of the present. There are only a few like him, having the benefit of such a ripe experience, and have marked time with the younger generation; this fact is what makes him a unique character among railroad shop managers.

Baltimore & Ohio Relics.

It will be seventy years on the 4th of July, 1898, since the corner-stone of the present Baltimore & Ohio Railroad was laid in Baltimore by Charles Carroll, of Carrollton, who, as is well known, was one of the signers of the Declaration of Independence.

This fact was brought to mind this week by the removal from the Baltimore & Ohio treasurer's vault to the Masonic Temple, in Baltimore, of the masonic emblems and tools which were used by Gen. Carroll during the ceremonies of laying the corner-stone. They consist of badges, a trowel, a spade and a stone-cutter's hammer, and also the apron worn by Thomas Young Nichol, a working stone mason, who performed the actual labor of setting the corner-stone in its place. There was a very large procession of mechanics, military, etc., on that day, and one of the relics still preserved is a tin cup made by the tin plate workers who were in the procession on a large float.

Mr. D. H. Stewart, of Penrith, N.S.W., writes us a letter of considerable length, requesting that our readers urge locomotive designers to devote greater attention than they do to make easy-riding locomotives. The principal change he wants made is to put a pair of trailing wheels behind the firebox to support the hind part of the locomotive, and prevent the jolting from rough joints. We are inclined to think that the trouble with rough-riding locomotives is much more conspicuous in New South Wales than it is in the United States, and we are afraid that any influence that we have would not go very far with designers of locomotives for foreign countries.

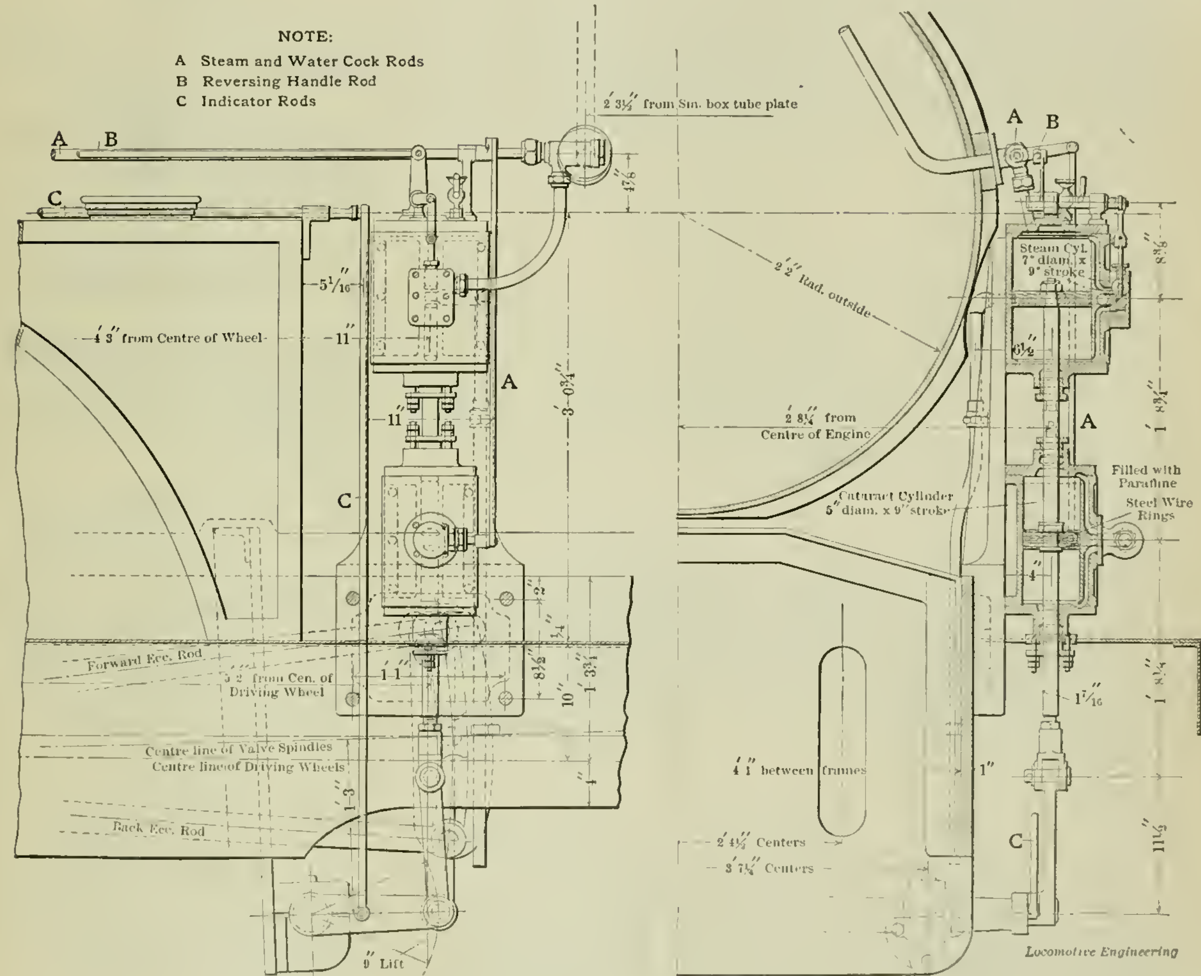
A bill has passed Congress granting the Richmond Locomotive Works $69,550 for claims in connection with the machinery built for the United States battleship Texas. The claim made was for $80,000, and it seemed eminently just. There is not much inducement for private firms to make machinery for the United States Government, when they can by hook or crook find something to do for private companies which are ready to pay reasonable prices for work done.

South Eastern Railway—Steam Reversing Gear.

We have received from Mr. Jas. Stirling, mechanical superintendent of the South Eastern Railway of England, drawings of his steam reversing gear, which, he writes us, he has applied to his engines for the past twenty-five years. The gear, as shown in Fig. 1, is arranged vertically just forward of the main driver, with its piston rod in line with the reverse shaft arm. The sectional view shows the two cylinders, the upper for steam and the lower for paraffine with which it is filled, and which is displaced from end to end of its cylinder in accord with the movement of its piston. In this view is seen the dry pipe and the steam pipe leading to the valve chest of the steam cylinder, which has a small slide valve with very little lap to admit steam to either end of cylinder, with a slight movement of the reversing handle.

The rods by which the gear is operated are shown broken in Figs. 1 and 2, with reference letters to indicate their functions. There are three of them, situated in the cab on the right-hand side, conveniently within reach, as shown in Fig. 2, two of which are for manipulation, and the third indicates on a dial the position of the reverse shaft and links, the dial presumably showing the point of cut-off, although there is nothing to show that such is the case aside from the supposition. Rod *A* extends to the reversing throttle, which is in connection with the dry pipe, and has a rotary motion through its lever, turning a double-threaded screw in the valve case, pressing against a flat-faced valve and admitting steam from the dry pipe to the slide valve of the steam cylinder. A continuation of the rod *A* extends down from a lever on the throttle stem to a valve, similar in action to the throttle valve and which controls the passage from end to end of the paraffine cylinder. These valves are shown in detail in Fig. 3. Steam is admitted to the reversing cylinder by a longitudinal movement of the rod *B* through its lever, which performs the duty of a reverse lever and actuates the slide valve so as to admit steam to either end of cylinder.

It seems that the mechanical superintendents in England have not evinced much interest in this device until recently, notwithstanding Mr. Stirling's long use of it, and he expresses surprise that some of them are just beginning to talk about it. A steam reverse was in use several years ago in this country on two or three roads, but it has been abandoned, which appears strange in the light of its long and successful career on the South Eastern Railway.



STIRLING'S STEAM REVERSING GEAR.

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Traveling Engineer Keith informs us that it is the fashion among the engineers on his road to occasionally open the cylinder cocks when drifting down hill, or when shut off for any cause. The object is to rid the cylinders of condensation and thereby save oil, it being found better to let the water out by the cocks than by the stack. An unmistakable saving of oil is effected by a systematic observance of the rule.

New York Electrical Exhibition.

There was an interesting electrical exhibition last month at the Madison Square Garden, in New York, and several of the well-known machine and railroad supply concerns had attractive exhibits.

The Cleveland Twist Drill Co. had a case showing their products with a line specially adapted to electricians' use.

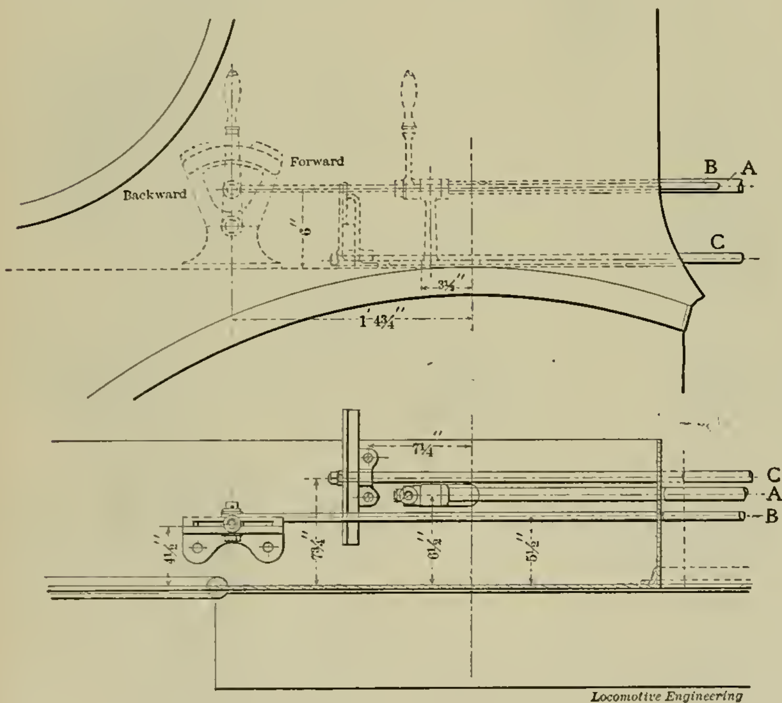
The Gold Heater Company, well known for their steam heating apparatus, are also making an electric heater which seems to be well liked by electric railroads. Their exhibit of this line of heaters was very interesting to street car men.

The Sprague Electric Co., of New York City, makers of the Sprague electric elevators, Lundell motors and other devices, have a large exhibit showing the machines in operation, which is the surest way to attract attention. Moving machinery has a fascination for even those who don't know which end of a locomotive goes first.

The Niles Tool Works were represented by an exhibit of lathes and similar tools particularly adapted to electrical work.

The exhibition contained much of interest to the average visitor, the Moore Chapel, lighted by vacuum tubes instead of regular electric lamps, being especially attractive, and showing one of the possibilities of electric lighting in the future. This is the nearest approach to daylight yet attained, is practically invisible in daylight and has no heat.

Submarine mines and torpedoes were illustrated by blowing up a toy ship anchored over a sunken mine in a tank of water.



STIRLING'S STEAM REVERSING GEAR.

Westinghouse Apparatus at the Boston Terminal.

The new Southern terminal railway station at Boston is a good illustration of the scope of the Westinghouse manufactures. The switches and signal system are to be provided by the Union Switch & Signal Company; the engines by the Westinghouse Machine Company; the Westinghouse Air-Brake Company will equip the rolling stock, and all the electrical apparatus will be supplied by the Westinghouse Electric and Manufacturing Company. The electric installation is to comprise 1,000 horse-power of dynamos and motors. The station, when completed, will be the finest in the country. Electricity will be used for lighting, for driving pumps, ventilating fans, etc.

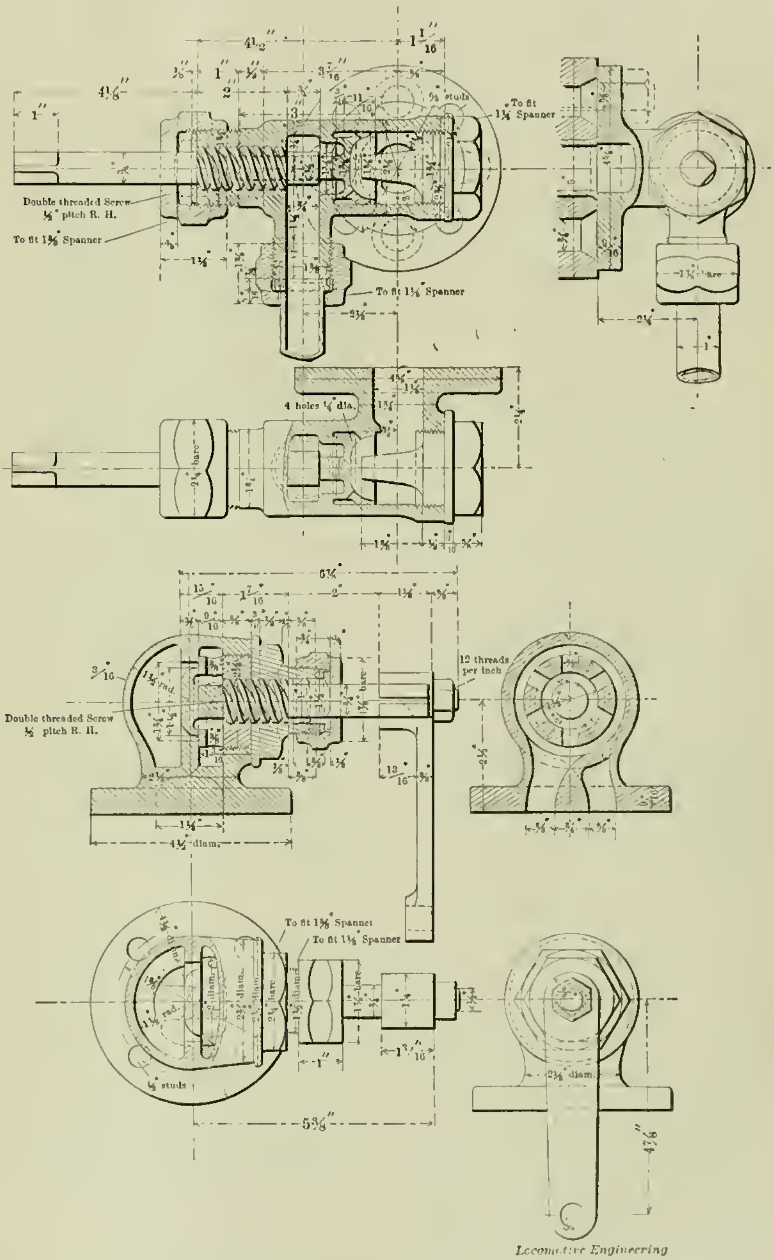
A very simple method of keeping a lubricator clean and in good working order has been mentioned to us by Mr. George W. Page, an engineer on the New York Elevated Railroad. Every day he puts into the lubricator a small piece of brown soap, about the size of a big pea. That does the business and prevents all the maladies which the ordinary sight-feed lubricator is heir to.

Smothered in a Tunnel.

William H. Kennedy, a locomotive engineer on the Norfolk & Western, was smothered by gas in a tunnel near Bluefield, W. Va., about a month ago. The *Baltimore Daily American*, describing the accident, says:

"The place where the accident occurred is described as a death trap. The tunnel is nine-tenths of a mile in length, and the grade is from 105 to 110 feet to the mile. The roof of the tunnel is said to be not more than 18 inches from the top of an engine's smokestack, while there is not more than 14 inches of space on either side of the cab. Near the end there is a curve of 13 degrees, which practically cuts off all ventilation.

"Kennedy's train became stalled on the grade, and the flood of gas and steam which poured down rendered him, the conductor and fireman insensible. The engineer died soon after being taken out."



STIRLING'S STEAM REVERSING GEAR.

An order has been issued by the Pittsburg & Western, requiring trainmen to purchase better watches than what they have heretofore carried. Up to the present time fifteen-jeweled watches of any good make were used and passed inspection, but hereafter all watches used by trainmen and telegraph operators must be seventeen-jeweled chronometers of the best make. We understand that an agitation in favor of similar action is going on on several roads. The men to whom the order applies are by no means pleased with it, and they freely express the belief that the order has not been made because the watches formerly carried were not good enough timekeepers, but because certain watch-making interests in Cleveland had put special pressure upon watch inspectors and got this order issued. The men say plainly that there is too much community of interest between the sellers of watches and the watch inspectors.

An official of the Pennsylvania writes: "I had a gas engine at Sharon, Pa., running a pump, and the man that had charge of it allowed the lubricator to run dry and cut the piston, piston rings and cylinder. The makers of the gas engine said the cylinder would have to be sent to the shop and bored out and a new piston put in. It was our busy season and we could not do without water. I had some of Dixon's finely pulverized graphite, and I commenced to feed it into the cylinder through the suction pipe with the air and gas, with immediate relief. After about two weeks the engine was running smoother and using less gas than ever before. I had this same engine apart last Saturday ,and every place that was cut is smooth as glass. This one instance saved us about $75. I have great faith in this graphite and always keep it on hand."

The Pennsylvania Railroad, which has always been noted for employing engineers with scientific training, has recently had to part with two of its assistant engineers, who have been ordered to duty in the army and navy. Nettleton Neff, an assistant engineer on the Pittsburg, Ft. Wayne & Chicago, has been ordered to San Antonio, Texas, for duties with the Roosevelt rough riders. J. T. Bootes, of the Cleveland & Pittsburg, has been ordered for duty in the navy at Boston. He has been given the rank of lieutenant, junior grade. Mr. Bootes was formerly a cadet at Annapolis, and when the war broke out, he immediately offered his services to the government. So says the *Pittsburg Post.*

Private car companies have always had a bad reputation for throwing upon railroad companies the trouble and expense of caring for their cars and for keeping them in running order without due compensation for the work done. Private car companies have held a conspicuous place in the disputes arising in interchange of cars referred for decision to the Arbitration Committee of the Master Car Builders' Association. We have recently learned of a new iniquity which stands against the owners of private cars, for of all the cars cut out for five weeks on the Louisville & Nashville System for brakes being inoperative, 41 per cent. were on private-line cars.

Part XI of J. G. A. Meyers' "Easy Lessons in Mechanical Drawing and Machine Design," contains several pages of illustrations and description of drawing projections, one of the objects being a locomotive tool-box. Laying out the surfaces of objects such as is required for sheet-metal work, is also shown. Several patterns of elbows and piping are also illustrated, and the methods of laying them out. Under the heading of useful data, the effect of forces acting on each other and the parallelogram of forces are shown. It is a very good number, and can be had of the Arnold Publishing House, 16 Thomas street, New York.

The Standard Coupler Company, New York, have issued an illustrated pamphlet, showing the Standard steel platform which they have put upon the market. This platform was designed by Mr. Henry H. Sessions, so well known through his connection with Pullman, and it overcomes certain serious and universally conceded defects in wooden platforms. The pamphlet gives a great deal of useful information about car platforms, and ought to be in the hands of every official responsible for the safe operation of passenger equipment. Those who have not received it ought to send for the pamphlet.

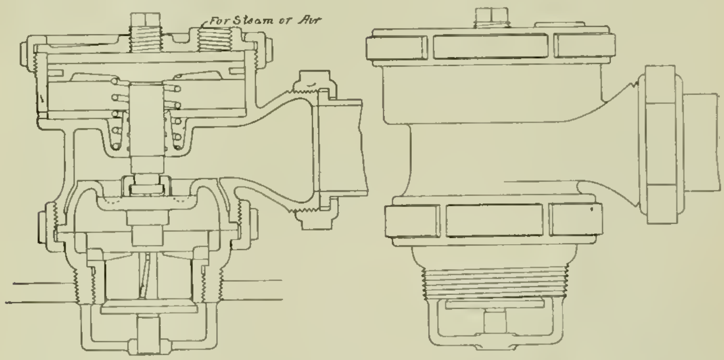
The St. Louis Railway Club is wrestling with the question of Demurrage for Detention of Cars. If the members of that club succeed in reducing the practice of using cars as storage warehouses they will confer a great benefit on railroad companies; but, unfortunately, the men belonging to railroad clubs have little influence in abating an evil which is a heavy tax on certain classes of the community, and is used as a means of discrimination to help favored shippers of freight.

The summer meeting of the American Society of Mechanical Engineers commences on May 31st, continuing to June 3d, at Niagara Falls, N. Y. Mr. Chas. W. Hunt, of New York, is president. A list of very good papers was prepared for the meeting, and we have no doubt but what a very profitable time will be enjoyed by the members.

Duplex Safety Blow-off Cock.

In districts where feed-water is charged with impurities, the safety, the durability and the economical operation of a locomotive boiler is influenced very much by the means provided for blowing out the mud and other impurities at frequent intervals. Until Mr. W. McIntosh, master mechanic of the Chicago & Northwestern, grappled with the question there never was a decent blow-off cock upon a locomotive boiler. Before that time all blow-off cocks were so defective that opening them was a serious matter, and when they were once opened they leaked for days until mud made them tight. The consequence was that the blow-off cock was very rarely used.

Mr. McIntosh realized the worthlessness of the plug blow-off cock and made a radical change by inventing the Duplex blow-off cock, shown in the annexed engraving. This cock is not opened by



wrestling with a long rod and expending wrath and hard words on the lever. Power is provided to overcome the boiler pressure and all that the engineer or fireman has to do is to open a small admission valve. An examination of the engraving will show that it is an ingenious appliance. Steam or air is admitted to a piston on the top, which overcomes the resistance of a coil spring that holds up the opening stem. This resistance being overcome, the stem referred to is forced down and pushes open the valve. Removing the pressure lets the valve return to its seat. The operation is very simple.

We are pleased to learn that this admirable device has been put upon the market by Jerome Metallic Packing people, Chicago, and that they are pushing it into adoption.

One of the mysteries of railroad legislation is that in all the agitation in favor of reduced rates, and in all the efforts to reduce the cost of transportation, the express companies have passed untouched. Yet there is no doubt that the rank and file of the public suffer more from the inordinate charges of express companies than they do from the rates imposed by railroad companies. Railroad freight rates are moderate, while express companies' rates are outrageously high. There must have been very skillful legislative management to exempt express companies from the working of the Interstate Commerce Commission's control of the regulation of freight rates. It would be highly interesting to know how much boodle was expended in this notorious deal, a deal that inflicts more injustice upon American householders than any transportation deal ever put through.

The Metropolitan Street Railway Company has made a contract with the American Air-Power Company for the equipment of the Twenty-eighth and Twenty-ninth street line, New York City, with the Hoadley-Knight air motor. The contract is for the complete equipment, including twenty cars, which will be of the same type and external appearance as the Broadway cars. Mr. A. A. McLeod, formerly president of the Reading Railroad, has become president of the American Air-Power Company, and is proceeding in his usual energetic fashion to push the business of the company. The Ingersoll-Sergeant Company will supply the equipment for compressing the air to be used with these motors.

A long list has been published by the *Railway Age* concerning the position that railroad companies take concerning men in their employ who enlist for the war. As might be expected, most of the railroad companies will do their best to restore the men to the positions they left, with all the rights usually accorded to a man who has been in continuous service. Railroad companies are much more liberal in this respect than most other corporations.

We are already receiving kind words about Halsey's book on Locomotive Link Motion. A railroad official who sent us 50 cents for the hook—the price we first settled on—has sent us the other 50 cents and remarked that the book had been received and was well worth the price asked for it.

At the Waterville shops of the Maine Central, Superintendent of Motive Power Pillsbury is putting on cast-iron running boards under the cabs, for the purpose of having a solid foundation on which to fasten the cabs, which were racked to pieces in a short time without it. There is another and more important advantage in a metal foundation for a cab, and that is the one of security from the caress of a broken side rod, an element of danger that very little provision is made to avert. A ⅜-inch wrought-iron plate would be likely to afford a certain measure of protection, in disputing the passage of a broken rod long enough to let a man get away from the dead line.

The Ladies' Auxiliary of the Brotherhood of Locomotive Engineers met in convention last month at St. Louis, and their sessions were held at the same time as those of the Locomotive Engineers' Convention. The ladies boast that in connection with this organization they have the only insurance company in the world managed exclusively by women. The wives of the engineers can get liberally insured for the benefit of their families at their death, and it is a perfectly managed institution. Mrs. Chester Durnell, of Fort Wayne, Ind., is the president of the company; Mrs. M. C. Orr, Peoria, Ill., secretary and treasurer.

A flue welding and swaging machine built on the principle of the tilt hammer, but occupying not more than one square foot of floor space, is used on the Maine Central. It is a novel and very efficient little machine for the work, and is operated by a friction clutch from a treadle, to throw it in and out of gear. There are two arms about 6 inches long revolving in a vertical plane on the driving shaft, raising and releasing the hammer die twice in each revolution. A spring forces the hammer head to the anvil half of the die as soon as the revolving arms free themselves from the hammer.

On the fourth of next July it will be seventy years since the corner-stone of the Baltimore & Ohio Railroad was laid in Baltimore, by Charles Carroll, of Carrollton, last surviving signer of the Declaration of Independence, and last week the tools used by Gen. Carroll were removed from the B. & O. treasurer's vault to the Masonic Temple in Baltimore. They consist of a trowel, a spade and a stone-cutter's hammer, also badges, and the apron worn by Thomas Young Nichol, a working stone mason, who performed the actual labor of setting the corner stone in its place.

The Pittsburg, Bessemer & Lake Erie has issued a neat little illustrated book of forty pages, giving illustrations and descriptions of points of interest on the line. The handsome station at Conneautville leads the list of illustrations, and is the only station honored with a place in the book. Numerous views of Conneaut Lake and vicinity, Shadeland, Conneaut harbor, the big lake ferry steamers, etc., go to make up a valuable medium for drawing travel over the line. Those who would like to have this attractive work of art should apply to the general passenger agent, Pittsburg, Pa.

There is a valve motion model on the Maine Central that is one of the best-used devices on the system. This model is full size and adjustable in all its parts; no wabbly, no springy parts to vitiate results, and while stiff and firm, it is light. It is one of the few valve motion models at which we ever cast a longing eye, for it had an air that seemed to assure a man that it was worth his time to demonstrate a point if he wanted "dead right" figures. Master Mechanic John Ellis built it at the Waterville shops, where it is located, and helping to a proper understanding of the link.

The Standard Pneumatic Tool Company, Marquette Building, Chicago, Ill., are making a specialty of piston air boring machines for wood work. These machines have become very popular with car builders, and greatly facilitate the work. The motto of the makers is, "One hour's trial is better than a thousand testimonials." We do not know how a car shop man can get along without machines of this kind. The next best thing to sending for one of the machines is to send for the illustrated catalog, showing the kind of work they do.

Every man interested in details of locomotives and cars ought to have in his possession our three educational charts, the transparent engravings of locomotive 999, of the passenger car and sleeper, and the colored air-brake diagram. The three are sent for 50 cents. We notice that the two first-named charts are to be found framed in nearly all railroad offices.

The Ridgely & Johnson Tool Company, of Springfield, Ill., have issued a neat little catalog of their pneumatic hammers and riveters. These appear to be very simple and are said to be very efficient. Those interested in pneumatic tools—and who is not at the present time? —should send for a copy of the catalog.

In our May issue we made a notice of a pamphlet published by the Galena Oil Company, which we thought was called "Ocean to Ocean." Many applications have been made for the pamphlet and we are informed that some mistake has been made and that the company have none to send out.

The Debombourg Welding Machine.

A device of utility to the blacksmith has made its appearance in two of the Erie Railroad shops—at Galion and Jersey City—so we were informed by Superintendent of Motive Power Mitchell, which on investigation were found an efficient tool for certain operations in the smith shop besides welding—say, for instance, upsetting and drawing. In the latter operation they are said to do a remarkably smooth job, since the metal is stretched without the defacing mark of the hammer, which is a point for consideration in many cases where a finished job is a trifle too short, and to draw it under the hammer would mean the destroying of that finish in the pounding necessary to increase the length.

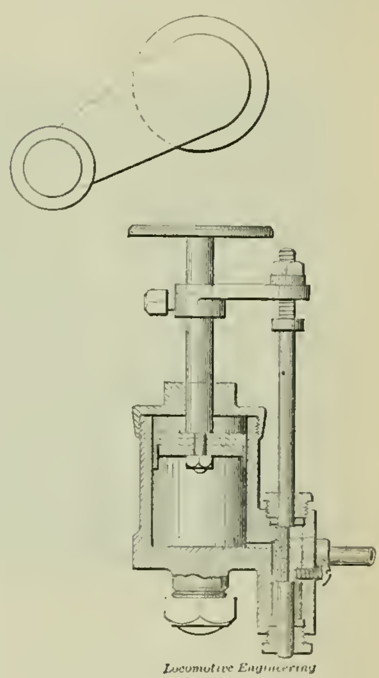
These machines are quite simple and have but few parts, which consist mainly of a wrought-iron frame carrying two pivoted levers, which are fitted at the top with steel gripping jaws having serrated faces, and are capable of taking in pieces up to 6 inches diameter or width. These grips hold the pieces to be welded, and they are made to approach or recede by means of a shaft located between them, on which is a pair of cams having links connecting them to the pivoted levers. A long hand-lever is used on the cam shaft, which gives sufficient force through the cams and levers to make a perfect butt-weld as soon as the pieces are in contact.

A sample of the work done on this machine was seen at the Jersey City shops, in the welding of a 6-inch shaft out of a drawbridge; the job was all that could be desired. Locomotive frames have also been welded on the same machine recently, with highly satisfactory results, and the device seems to be popular with the men because of the ease of manipulation as compared with the steam hammer and lap-weld method. To an air crank, the hand-lever which is used to get the squeeze on the cams, looks a little antiquated, when an air cylinder bolted on the machine frame could, through a rack on its piston, be made to engage with a gear on the cam shaft, and so easily supplant all tension on the spinal cord of the helpers, besides give them an opportunity to recuperate. Improvements will be made in this direction no doubt, now that the machines have shown their adaptability to railroad blacksmithing. We understand a 3-inch round bar was welded in three minutes at the Galion shops on the machine at that point, and when the bar was subjected to a tension test, it broke outside of the weld.

The Baldwin-Westinghouse Electrical Company have obtained a contract for equipping the Kings County Elevated Railroad of Brooklyn with electric motors, and the machinery for operating them.

Bartow's Bell-Ringer.

Our engraving represents a sectional view of a new bell-ringer, operated by air or steam. The piston is packed in the usual way, and is forced in the upward direction only, by means of a cylindrical valve which admits the motive power on the under side of the piston. The latter is fitted at the top of its rod with a disk, which, in moving upward with the piston, engages the anti-friction roller shown on the bell-crank above it, and forces the latter and the bell through a small arc. The valve is manipulated by means of the clamped arm on the piston, and in the upward movement of the latter the arm engages with the collar on the valve stem and moves the valve upward into the position shown; the admission port is then closed,



BARTOW'S BELL-RINGER.

and the exhaust ready to open. The bell crank returns to a nearly vertical position (just off the center) by gravity. The piston in its downward movement forces the valve stem and valve down by contact of the arm with the lower collar on the stem, closing the exhaust and again opening the valve to admission, repeating the order of movements described, and continuously ringing the bell.

The Ohio Steel Company has decided to add two mammoth blast furnaces to its plant at an outlay of $1,000,000. It is to manufacture Bessemer pig iron, and the plant, it is claimed, will be the biggest iron producer in the world. It will take a year to erect the furnaces.

Car Cleaning.

At the May meeting of the New York Railroad Club, a paper on the subject of car cleaning was read by Mr. F. T. Slack, of the New York, New Haven & Hartford Railroad. It was an interesting contribution to the club, on a subject that has of late enlisted the liveliest attention of railroad men in a direction that requires more thought than the subject would indicate by its title. Mr. Slack gave his method of cleaning and disinfecting in detail, and the cost for same, besides presenting figures for the same work on other roads, which included the cost for inside and outside cleaning.

In detailing the means used to remove the smoky deposit from the exterior of a car, the action of corrosive substances, generally used for the purpose, as acids, the use of which was deprecated, except as a last resort to keep cars presentable until shopped, and caustic sodas and potash. A combination of a semi-soft soap with hot or cold water had been found very efficient in outside cleaning, provided there was not an excess of alkali in the soap. The part of the subject open to discussion practically centered on which was the liveliest agent for the removal of the effects of smoke and gases, and yet do the least harm.

The discussion that followed was opened by Mr. McCoy by recounting some of the necessities for more attention to car cleaning, but who could not say just what was the best means to the end. Mr. Mendenhall (in the chair) stated that the railroads did not keep their equipment in as cleanly a condition as private owners. Conservative management would not allow the expenditure. Mr. Appleyard thought that the criticism of the condition of cars, by the patrons of the road, should be an incentive to renewed efforts. If managers could be brought to a realization of necessity for better cleaning, beneficial results would follow. His experience was, that anything that would cut grease would also cut paint and varnish, and believed that simple methods in cleaning would be a long stride in solving the problem. The traveling public is to blame for the vile condition of the smoking cars, and should be held responsible for it.

Mr. Hodges, in an interesting talk on the chemistry side of the subject, said that different dirts required different solvents, and gave the emulsion used by the Chesapeake & Ohio—water, mineral oil and tripoli, also experiments made by himself with an imitation of the above, which gave a lustre after cleaning. The speaker regaled the members with his experiments with the new disinfectant, Formaldehyde gas, made from formic acid, which he stated absolutely destroyed the odor as well as disease germs, the vapor making water closets clean and pure. This, he stated, was one of the most valuable discoveries of recent years, since the gas does not affect wood or any fabric. The cost is not prohibitive, one pint of the acid costing only 6 cents, and can be diluted with 2,000 pints of water, while still preserving its deadly properties for disease germs.

Mr. Forney said that among other things science had done for us, it had put us in touch with microbes, bacilli and other pests, to worry and make us afraid. He was glad that an agent had been found at last to make it hot for them, and told one of those stories of his that always have a point, about a party who lived in Albany, where they drink river water coming by the city of Troy. This party had but a meagre knowledge of bacilli and things, but he was satisfied that they had a settlement of them up the river, because when they ate asparagus in Troy, he could taste it in the water at Albany.

A peculiar phase of the discussion was, that reference was barely made to air as an agent in cleaning. This is a matter for comment, since air plays a very important part on many roads in interior cleaning at this time. Mr. Slack closed by saying that there can be no general rules laid down to govern car cleaning, and local conditions must therefore govern. He hoped the paper would awaken an interest in the matter for future consideration. This meeting was the last of the winter series, and it was adjourned to the third Thursday in September.

Standing Up for Dad.

There's a good story floating around Elmira, N. Y., about one of the stay-at-homes from the Thirtieth Separate Company, now company L of the Third Provisional Regiment of New York.

The little boy was very late coming home from school one night after the company went into camp, and Mr. Weak Knee said: "My son, why are you so late to-night?"

"Couldn't help it, dad; couldn't get home any sooner; had to lick three boys who said you were a coward." The boy wasn't punished for being late.

The Baldwin Locomotive Works are issuing monthly catalogs of locomotives of recent construction. The April number is before us, and is a very interesting pamphlet. The locomotives shown are mostly for foreign countries, and they give a very good idea of the difference between foreign and American locomotives.

For the past four years the Wisconsin Central passenger cars have been fitted with iron headlining, made of 1-16-inch material. It makes a very trim and neat appearance, and is preferable to wood, in that it is practically indestructible, and can be formed to intricate shapes at less expense.

Heavy Steel Casting.

The annexed engraving was taken from a photograph of a steel casting made by the Lima Locomotive & Machine Company, Lima, O. This casting, which is 18 feet long, 18 inches in diameter and weighs 14,650 pounds, was made at the company's works by the acid open-hearth process. It was made for the Midland Steel Company for use in their works at Muncie, Ind. Those who examined this large casting said it appeared to be perfect in every respect.

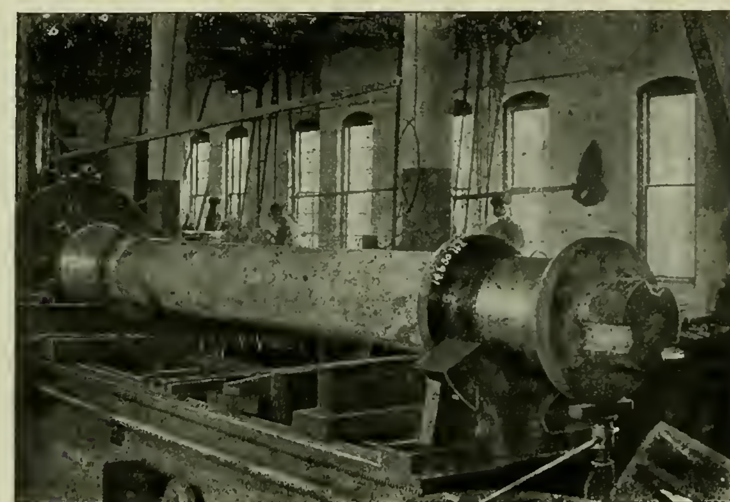
Prejudice Against Steel.

For some reason there has always been a strong prejudice among many railroad men against the use of steel for purposes where the material is subjected to severe stresses. The prejudice has been slowly yielding before the force of reason and increase of knowledge, but there are still not a few superintendents of machinery who prefer iron for piston rods, crank pins, and even for axles.

Those who continue to cherish their prejudice against steel ought to read a paper on the "Fatigue of Metal in Wrought Iron and Steel Forgings," prepared by Mr. H. F. J. Porter for a meeting of the Franklin Institute, and to be obtained from the Bethlehem Iron Company, Bethlehem, Pa.

It is common to hear men who are prejudiced against steel say that it is brittle and snaps suddenly, while wrought iron does not, because it is fibrous. This is a paradox, for steel cannot be stronger than iron and more brittle. All the tests of iron and steel, under even conditions, show steel to be very much the stronger material, and the tests of service point in the same direction, if they are only read rightly. What makes wrought iron fibrous is slag incorporated in the process, and slag certainly cannot add to the strength of the material.

We regret not having room to publish the pamphlet, for it ought to be read by all fair-minded railroad men. The best we can do is to urge them to send for it, and to assure them that it will prove very interesting reading.



HEAVY STEEL CASTING

The Pintsch gas is now used for lighting 83,582 cars in different parts of the world. Germany takes the lead with 31,335 cars, and England comes next with 16,854 cars. The United States is third with 10,809 cars, and India has 6,356 cars lighted by this gas. It has been applied to 3,184 locomotives, 3,121 of which are in Germany. Not a single locomotive in the United States has been provided with this gas, which is a rather surprising thing, considering the fine light it provides.

A recent letter to the Falls Hollow Staybolt Company contains the following: "In all my experience it is the first hollow staybolt iron I ever saw that would stand the tests, and I gave it some hard ones." It is probably because others feel the same way and to the reduction in price that this company reports a steady increase in sales of both hollow and solid staybolt iron.

The Joseph Dixon Crucible Company, Jersey City, N. J., have published an illustrated circular, giving directions how to use Dixon's scientific cycle chain graphites, for easy riding. The pamphlet contains information that will be useful to all bicycle riders, and will be supplied on application.

Free Air-Brake Instruction.

The American Magazine League has recently started a new enterprise in the shape of a free air-brake instruction car, which they are taking over the different roads which are not blessed with a car of their own, and giving free lessons to any railroad man who is interested. At present this car is at Middletown, N. Y., on the Ontario & Western Railroad.

This enterprise seems to be commendable in every way, for although the object of the car is to sell the "Standard American Encyclopedia and Dictionary," there is no obligation to purchase on account of the instruction, that risk being taken by the League. The car is in charge of a competent instructor, and the instruction is accordingly valuable, not only to the men but to the railroads, most of which are glad to have the car on their line.

The Encyclopedia which they handle is one of the best in existence, consisting of eight volumes of encyclopedia and two volumes of dictionary, so that both are combined in one, making a reference library which is of great value in any home. A distinguishing feature of this work is its biographical department, containing an account of about every living person of note whose work is worthy of record. It is brief, concise and yet comprehensive enough to give all the information usually desired, while its accuracy is attested by the fact that it was edited under the personal supervision of John Clark Ridpath, LL. D. It is profusely illustrated with wood cuts, half-tones and maps, and, taken as a whole, forms one of the best works of reference we have seen.

These retail, in half-morroco binding, at $60, but on the instruction car they are sold at about 40 per cent. less than this, and a year's subscription to Locomotive Engineering is given with each set. We believe they will make friends, and we trust the instruction car will be well patronized, regardless of the book end of it.

The Clayton Air Compressor Works, Havemeyer Building, New York, have had remarkably good business since the beginning of the year. During the months of February, March and April, nineteen air compressors were sold for operating pneumatic stone tools, chipping and calk-tools, air hoists, etc.; nine air compressors for moving and elevating acid and chemical solutions; four air-lift pumping plants were installed and placed in operation; three air compressors were furnished to rubber works for removing hose from mandrels, testing hose and inflating tires; one compressor was supplied for the pneumatic transmission of messages; two for oil-burning plants; three for racking off beer in breweries; one for spraying brick in the process of manufacture, and six for unusual applications of compressed air power. In addition to this number of air compressors furnished for domestic use, four were exported to Europe for operating pneumatic shop plants.

The American Brake Shoe Company, of Chicago, has been incorporated to manage all the business connected with the Diamond "S" brake shoe patents. Mr. William D. Sargent is president. This company proposes to watch the operation of the brake shoes they put upon the market as carefully as the Westinghouse people watch their air brakes and the Galena Oil Company their oil consumption. Experts will be put on the roads to watch the shoes, just in the same way as experts are employed by the other companies. The American Brake Shoe Company have granted licenses for the manufacture of their shoes to the Sargent Company, Chicago; the Ramapo Iron Works, Hilburn, N. Y.; Parker & Topping, St. Paul, Minn., and the Central Brake Shoe Company, Buffalo, N. Y.

A form of rail joint made by the American Rail Joint Manufacturing Company, of Cleveland, O., has been giving extraordinary service on the Pennsylvania and several other railroads in the West. It is a very simple form of boltless joint that grasps both sides of the rails and holds them with a most tenacious grasp. It not only prevents the deflection of the rails at the joint, but also is a thorough preventative of rail creeping. It is in use on several steep grades where great difficulty was formerly experienced with the rails creeping, and it has proved an entire preventative.

A new catalog has been issued by the Mason Regulator Company, of Boston, Mass., for the purpose of telling the world about the Mason steam pump. This is a very simple form of water pump, and is very highly commended by people who have used it. The catalog, which is very handsomely got out, shows a variety of fine cuts of the pump. Those interested in steam pumps should send for this catalog.

We have received from Prof. Wm. S. Aldrich, head of the department of mechanical engineering, West Virginia University, Morgantown, W. Va., a pamphlet giving particulars about the summer quarter. Those who are ambitious to become engineering students can obtain this pamphlet on application to Prof. Aldrich.

The shopmen of the Panhandle shops at Logansport have raised a very handsome sum and purchased a large flag, which will float from the tower of the shops. One has also been purchased to float from the passenger station.

LOCOMOTIVE ENGINEERING
A PRACTICAL JOURNAL of RAILWAY MOTIVE POWER AND ROLLING STOCK.

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An Upstairs Blacksmith Shop.

The blacksmith shop shown in the annexed engraving is where the lighter line of handwork is done for the Baldwin Locomotive Works. A notable thing about the shop is that it is on the top floor of a high building. It is one of the cleanest blacksmith shops we ever visited, and is practically free from gas and smoke. This results from the use of good close forges, which are connected with a chimney that carries off the gases. The arrangement of the shop is made so plain in the picture that a description is not necessary.

AN UPSTAIRS BLACKSMITH SHOP—BALDWIN'S.

Exceptionally Long Engine Running.

One of the most remarkable feats of long-distance engine running was last month performed on the St. Louis division of the C., B. & Q. R. R. on its through passenger service between Rock Island and St. Louis. The distance from Rock Island to St. Louis and return is 520 miles, the return trip being *via* the Lewiston and Peoria line. The usual run for a locomotive is from Rock Island to St. Louis on train No. 48, where engine is at once turned and sent back on train No. 49, when it is cut off and a lay-over of twelve hours given at Rock Island.

The schedule time between arrival of train No. 49 and departure of train No. 48 at Rock Island is five minutes. No. 49 arrives at 6.55 A. M.; No. 48 departs at 7 A. M. It was arranged that the engine arriving on No. 49 should be turned and started back immediately on No. 48. Starting with train No. 48 Saturday morning, the engine arriving on No. 49 Sunday morning and again Monday morning, was turned and started back to St. Louis, whereby six consecutive trips between

Rock Island and St. Louis were accomplished and a total mileage of 1,560 miles was made from the time the engine was started from the roundhouse at Rock Island until it again returned to the house, the engine being in continuous service.

The engine is a class "A," eight wheel, 17 x 24-inch cylinder, 56-inch wheel centers, fitted with the Eckerson grate and ash pan, by which means the fire was at all times in first-class condition and ash pan clean.

There were burned in making this 1.560 miles, 39 tons of coal, or an average of 40 miles run per ton of coal.

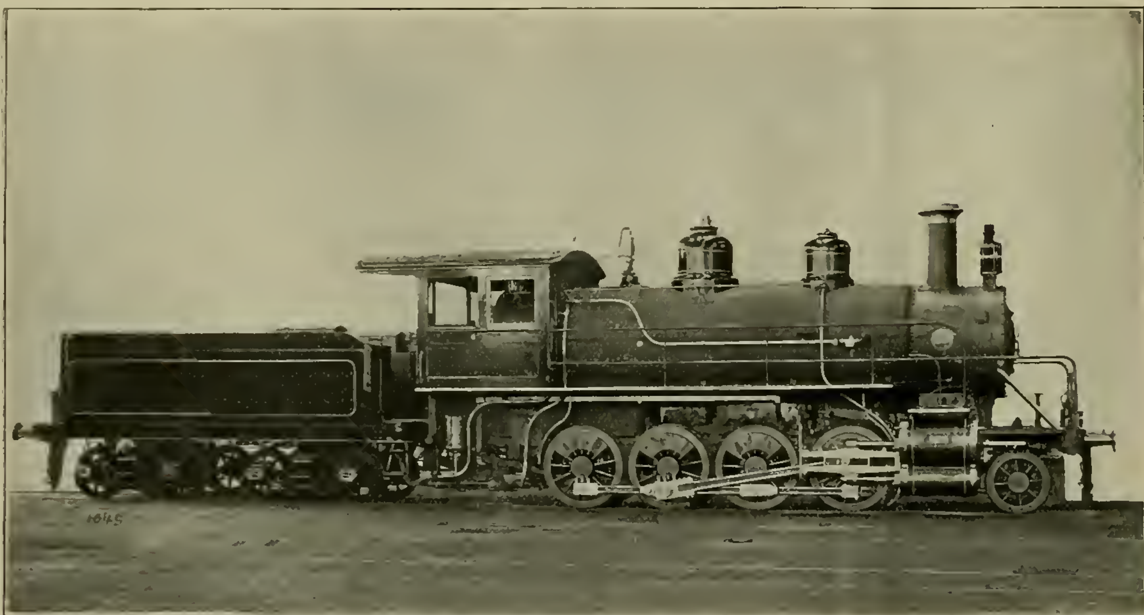
There were used 5½ pints of valve oil, making 283.6 miles to the pint of valve oil, and 11½ pints of lubricating oil, or 135.7 miles to the pint of lubricating oil.

All engines on the St. Louis division are handled in what is known as the pool system. There are eight passenger crews stationed at Beardstown, and these crews take the engines from Beardstown to St. Louis and return, or Beardstown to Rock Island and return, according as their "turn" catches the trip. By this system there was no other effort or arrangement necessary to enable the engine to make this great mileage than that it should be in good running order, and a quick turn given it at Rock Island. When cut off at Rock Island it might have again been returned had it been necessary, but it was thought best to cut off the engine for boiler washing. When washed out the water was not unusually muddy or the boiler in much different condition than when its ordinary trip is made.

Compound Consolidation for Russia.

The Vauclain compound consolidation engine here shown is one of a group recently built by the Baldwin Locomotive Works for the South Eastern of Russia. In many respects it is a representative American consolidation engine, the foreign peculiarities consisting chiefly of copper firebox and straight boiler.

The cylinders of the engine are 13½ and 23 x 26 inches; the drivers are 50 inches diameter; the driving wheel base is 13 feet 5 inches and total wheel base 21 feet 4 inches. The total weight is 131,350 pounds, of which 115,000 pounds are on the drivers. The diameter of the boiler is 64 inches and it contains 259 tubes, 2 inches diameter and 13 feet 6 inches long. The firebox is 7 feet long and 45 inches wide, and has 130.48 square feet of heating surface. The grate area is 26¼ square feet. The tubes present 1,813.77 square feet of heating surface, the total heating surface being 1,944.25 square feet.



COMPOUND CONSOLIDATION FOR RUSSIA.

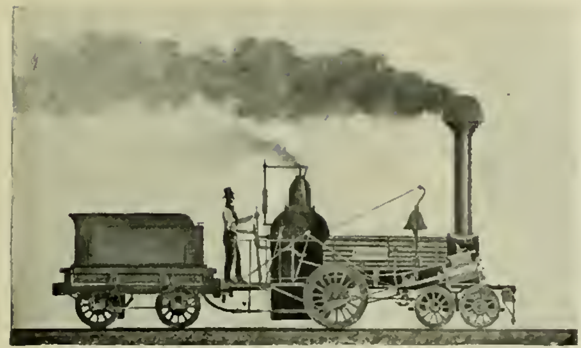
If ocular proof were needed to convince anyone of the invincible determination of the Hobo to "get there," it was furnished a short time since on the Milwaukee road. Two representatives of the leisured tribe were observed in a stock train loaded with hogs on the way to Chicago. They contentedly occupied the center of the upper deck in one of the cars, while the porkers were huddled at either end. It was not easy to see what advantages obtained in this method of travel over the stereotyped berth on the truck, but there must have been some attraction. Only an iron nerve inured to the toughest luck could voluntarily choose such a mode of transit.

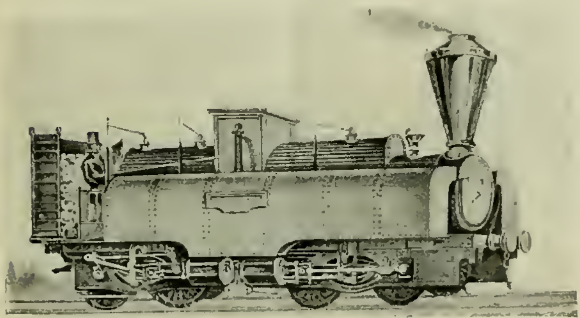
Graphic History of Austrian Locomotive Works.

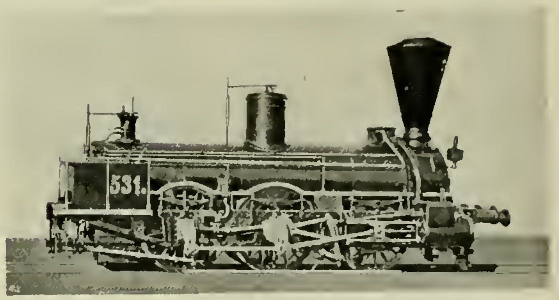
In connection with the foreign-looking locomotives shown on the following pages, we received from Mr. Hermann Von Littrow, of Neustadt, near Vienna, the pictures and the following letter:

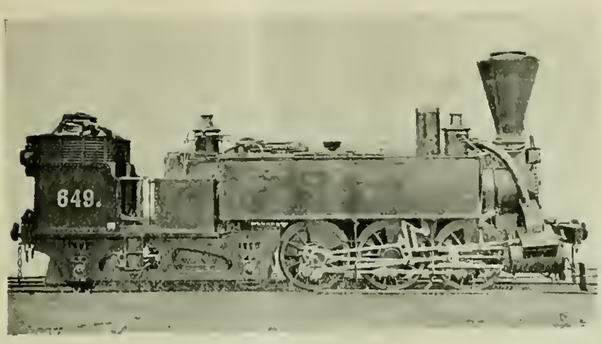
"Your twelve historical charts of locomotive types were not only interesting to your American readers, but also we on this side of the pond were fond of this brief history. So we think your American readers will read with interest the history of the greatest Austrian locomotive works, and see the types produced by them.

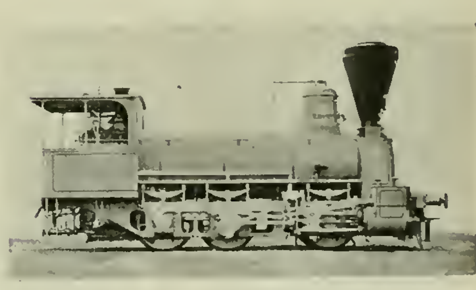
"The locomotive works erected by Wenzel Gunther in Neustadt, near Vienna, 1842, began working on an American Norris engine (see Fig. 1), which was purchased in your land in 1838. For heavy coal trains on the Northern Railroad they constructed the peculiar type (see Fig. 2), which was nothing but the old American imported engine with a coupled instead of a bogie wheel. The locomotive 'Neustadt' (see Fig. 3) was erected in 1851 for the famous Semmering Railroad, with its 2½ per cent. grades, the first real mountain railway in the world, with the beautiful Payerbach loop about seven miles long. This machine, of the well-known Meyer and Fairlie types, was not very successful in practice, so it was substituted by the Enghert engine (see Fig. 4), of which type over one hundred were built for Austrian and French lines, especially for heavy mountain service. The Enghert type is a tank engine with a tender bogie containing the coal bunker, and sustaining a part of the locomotive's











GRAPHIC HISTORY OF AUSTRIAN LOCOMOTIVE WORKS.

weight on its frame. Fig. 5 is a common passenger engine, built in hundreds up to the beginning of the seventies for almost all Austrian railroads.

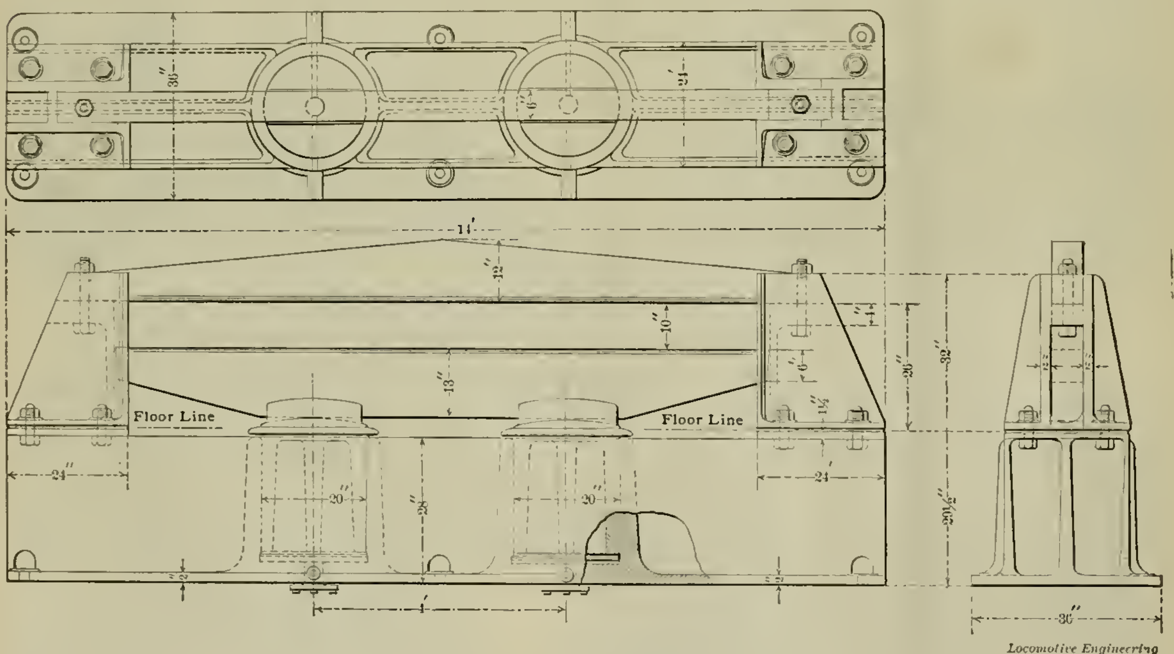
"In 1861 George Sigl, the owner of the ancient Norris Locomotive Works, of Vienna, bought the Neustadt Works, and began exporting, especially to Russia. Fig. 6 shows a goods engine for the Moscow Kursk Railway. Figs. 7 and 8 are the standard goods engines for Hungaria. In 1875 the Neustadt people came back to their original American models, with a passenger engine for Finland State Railroad, in Russia (Fig. 9). Heavy eight-wheelers for Italy, especially the Mont Cenis (see Fig. 10), and Russia (Fig. 11) followed. The stiff express engine, Fig. 12, was built for the Prussian State Railways.

"In the year 1875 the works came into the hands of a receiver, and afterwards a new company, the Wiener-Neustadt Locomotive Works, bought them for reopening. The works were widened; the first engines turned out were built on the Fairlie principle (Fig. 13) for the Caucasian railways; types for Austrian State branch lines (Figs. 14 and 15) followed. A lot of street tramway engines (Fig. 16) was delivered in and near Vienna and Budapest, and seventy engines to France (see Fig. 17). In 1885 express engines, especially for Austrian State railways, were built exclusively on the American pattern. The newest express type on this road, Series 6 (Fig. 18), a Goldsdorf compound, is as nearly a modern American express as the old turntables permitted. The '4,000' engine of Neustadt Works (Fig. 19) resembles, with its trailing wheels, much the new Baldwins of the Atlantic Coast line. This engine is fitted with Cook's safety valves, manufactured in Austria; speed recorder and steam sanding apparatus. The first Austrian consolidation compound for the State railways is shown in Fig. 20. The appliances are the same as in the former engine, except that this engine is fitted also with simple and automatic vacuum brake. These engines now pull freight and express trains on the Arlberg line, with 3 3-10 per cent. grade. I hope to bring in another issue views of Austrian cars and railroad scenery."

A Pneumatic Flanging Clamp.

The trend of improvement in boiler-shop tools is well shown in our engraving of a flange clamp operated by air. In this case the machine was designed with the object in view of using air to put the clamps under pressure, and the two cylinders were therefore cast in the lower frame, the top of which is flush with the line of the floor. The cylinders are 20 inches in diameter, and have pistons fitted with the usual leather packing, but of peculiar construction otherwise, being cored for lightness and made to fit the cylinder the full length, to serve as guides and keep their alignment while raising and lowering the clamp.

There are 10 feet in the clear between the housings and a movement of 10 inches between clamps. Air applied to a flanging tool is probably one of the best uses it has ever been put to in aiding the output of boiler-shop tools. It would appear to be a long stride in advance of the screw-squeezing style of the past for holding a sheet up to its work during the flanging process, and it has the advantage of losing no part of a heat through slow manipulation of the clamps—their work is instantaneous. This tool was designed and built by Superintendent of Motive Power Barnes, of the Wabash Railroad.

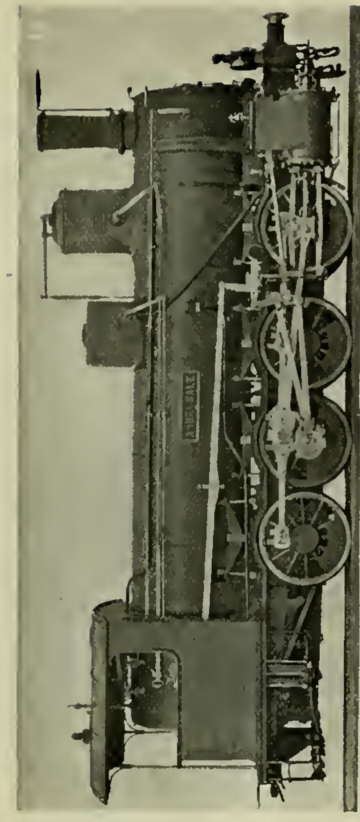


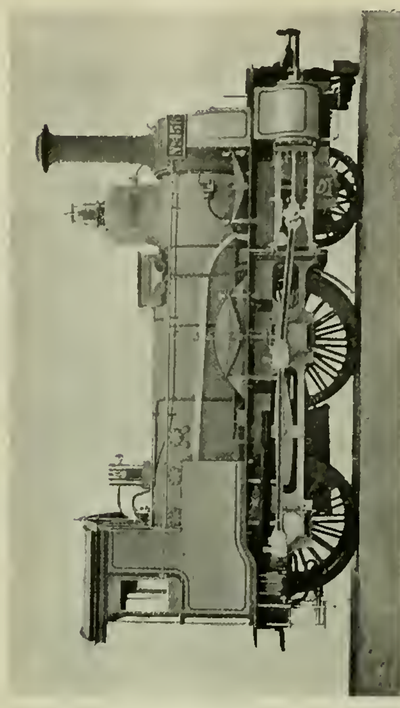
PNEUMATIC FLANGING CLAMP.

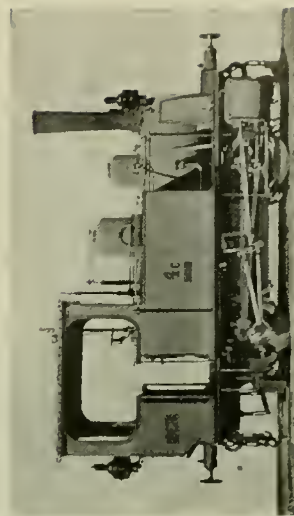
How Noises Affect Sleep.

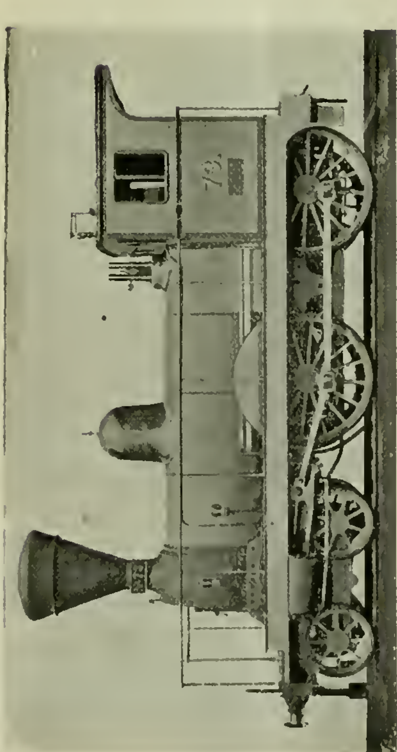
Hotels doing duty as railway stations are not so bad to sleep in for those who are inured, by association, to the clangor of switch engine bells, the banging of coupling cars, or the hoarse invitation to the engineer to "come ahead about two cars." All these sounds are as a mother's lullaby to railroad ears, but they would not allow an eye to close in slumber for those unused to them. On the other hand, the effect of lesser disturbing sounds is equally as bad to those that can get sweet repose in a boiler shop. We are reminded of this by an engineer who had been assigned a room in one of these hotels, on the side farthest removed from the din of trains. It was too still for him. He complained of the murmur of a little brook coming down over the rocks near his room.

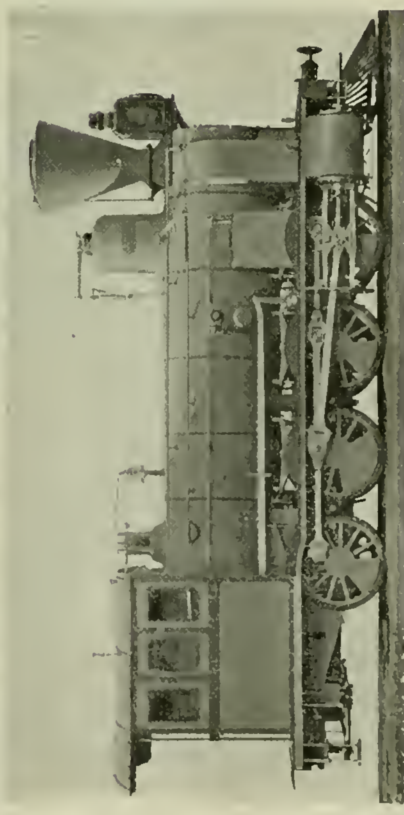
A New York genius has patented a locomotive having a return tubular boiler which brings the stack just in front of the cab. He proposes to force a pulverized fuel into the fire so that the draft from exhaust is evidently not necessary, but it is generally wise to consider existing conditions before tackling any great engineering problem.

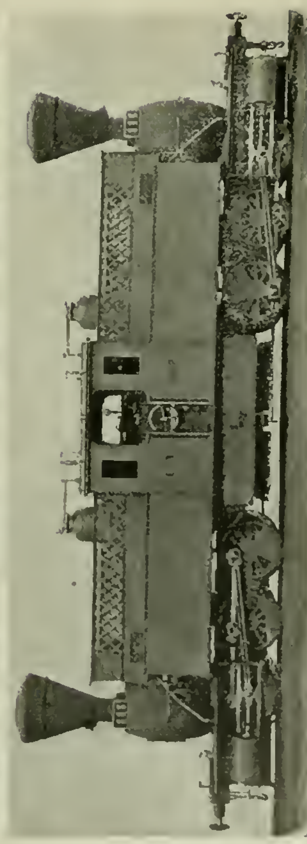












GRAPHIC HISTORY OF AUSTRIAN LOCOMOTIVE WORKS.

Some Dickson Engines for Export.

The Dickson Locomotive Works have recently completed the two small engines which are shown below, for service in distant lands.

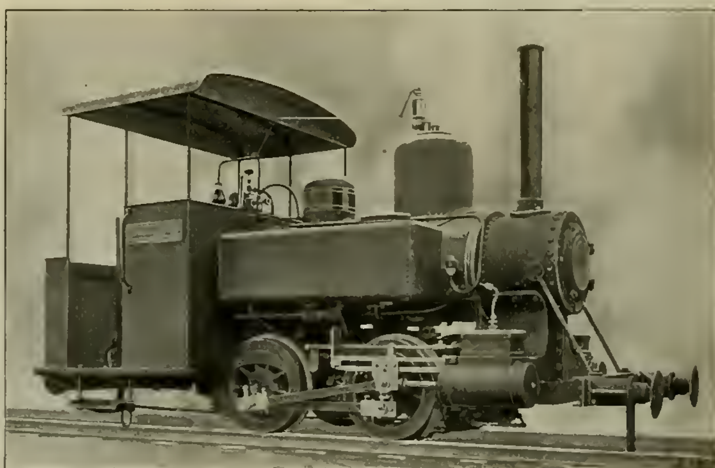
The "Sanyo" is a 42-inch gage engine, with its total weight of 43,550 pounds on its six drivers. The cylinders are 12 x 16 inches; steam pressure, 150 pounds; drivers, 37 inches in diameter; boiler, diameter, 36 inches; brass tubes (91), 1¾ inches diameter; heating surface, 309.5 square feet; grate area, 7.69 square feet.

The boiler is of ⅜-inch steel, and the crown sheet has radial stays and two rows (in front) of sling stays.

A RECENT DICKSON ENGINE FOR JAPAN.

There are two side tanks, each holding 250 gallons, while the coal capacity is 2,500 pounds.

The other is a little engine of 12,100 pounds, all on drivers, with cylinders 5½ by 8⅞ inches, probably to conform to their previous engines. It is a 3-foot gage, carries 180 pounds of steam and has a 23-inch boiler. The firebox is 19 inches wide by 24 inches long, making a grate area of 3.16 square feet. Total heating surface is 97.7 square feet. The boiler is ⅜-inch steel, but the firebox is of copper. Driving wheels are 24 inches in diameter. The side tanks carry 50 gallons each and only 500 pounds of coal are carried. Both of the engines are slightly under size now, but they may grow.



ANOTHER FOR BRAZIL.

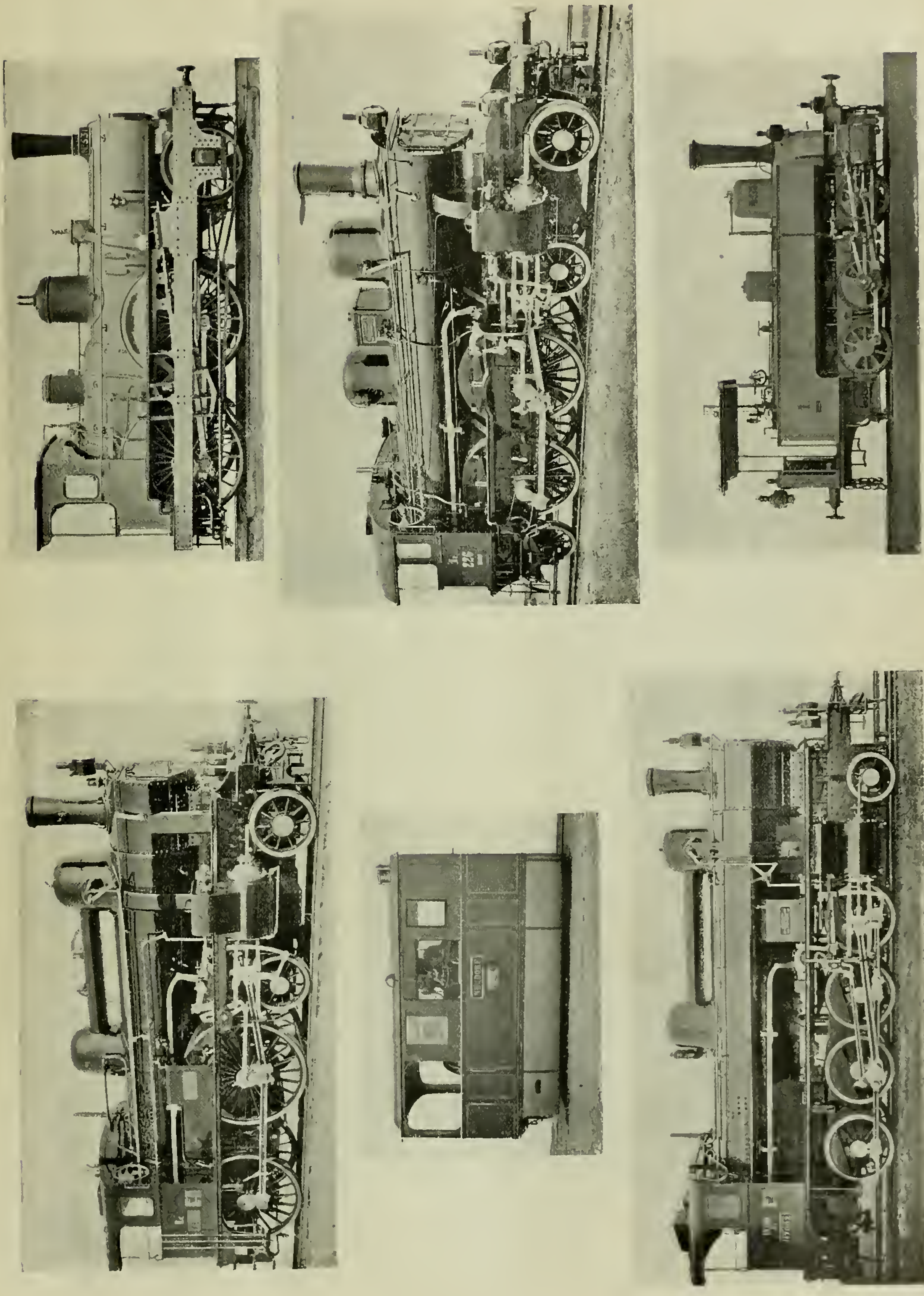
Notes from an Engineer in Russia.

Mr. W. F. Dixon, chief engineer of the Sormovo Works, Nijni Novgorod, Russia, is very well known to a great many of our readers through his long connection with the Rogers Locomotive Works, and we feel that anything he has written about Russia will be read with interest. Among a variety of interesting items which he recently wrote in the course of a private letter to the president of this company, he said:

"We have got our shops into pretty good shape here now, but are still troubled by the scarcity of good labor. Industrial Russia is growing so fast just now, and so many new industries are springing up in all directions, that the labor problem is becoming a very serious one not only for us, but for nearly all the other new works. The effects are also felt among the older concerns who have already been through the mill, gathering together and breaking in a sufficient number of workmen for their own requirements, as, of course, the logical result of a restricted labor market is to raise the standard of wages, and employers are finding it necessary to raise wages in order to keep their men together. We have found it absolutely necessary to follow the policy, which I believe to be the correct one in almost all circumstances, of getting in young fellows with little or no mechanical training and laboring with them until they become sufficiently expert to turn out a reasonably fair quality of work. With erectors, fitters and so forth, however, it is not feasible to pursue this policy to any great extent, as it is necessary that these men should know something when they start in, and it is with these that we have had, are having, and will continue to have for some time yet, our greatest difficulty. Of the Americans that I brought over with me hardly any remain, and I am now practically alone. All the foremen are now Russians, and I must say that some of them are extremely efficient men, both with regard to their knowledge of their business and to the discipline which they maintain in their departments. Our first engine was turned out several weeks ago, and after running for a while on a local road was ordered back to the shops by the railway officials, where it was taken almost entirely apart again, so that the condition of all the moving parts might be examined, measured and tested. It seems rather a curious performance, but at the same time no one can gainsay the fact that by these means it is almost absolutely impossible that bad workmanship or material should pass unnoticed."

In a recent issue of *Engineering* there are diagrams showing the distribution of the railways of the world. The United States leads, of course, all other countries, with about 184,000 miles of road. Germany and France follow with about 28,500 and 26,000 miles, respectively. In miles of railway per 10,000 inhabitants South Australia and Queenstown lead with 53.6 miles; the United States has 26.6 miles; France, 6.5; Germany, 5.5, and the United Kingdom, 5.3 miles. In length of railway per 100 square miles, Belgium leads with 30.3 miles, followed by the United Kingdom with 17.3 miles; Holland, 14; Germany, 13.7; Switzerland, 13.6; France, 12.1; the United States has 5.9 miles of railway per 100 square miles of territory. Our contemporary thinks the true test by which the various countries should be credited, and that which best determines the relative encouragement to agriculture and manufacturing, is the extent of railway per 100 square miles of territory.

Air-brake pumps are not economical air compressors for shops; they were not designed for that work.

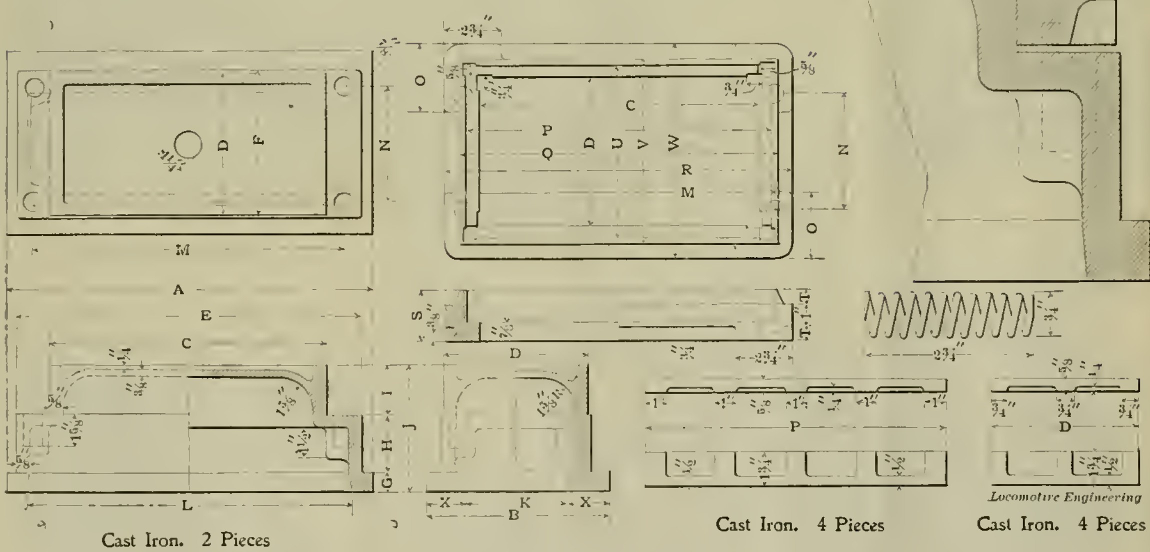


GRAPHIC HISTORY OF AUSTRIAN LOCOMOTIVE WORKS.

The Barnes Balanced Valve.

A balanced valve having some points with a strong flavor of originality, is that designed and patented by Superintendent of Motive Power Barnes, of the Wabash Railroad, and illustrated herewith. The full-sized part of a longitudinal section will perhaps give a clearer conception of the balance part of the device than will a first reference to the details. This view shows a cast-iron frame surrounding the valve, with a recess equal to the width and depth of the balance strips, on its inner face.

There are four balance strips ⅝ x 1¾ inches, carried in position by the frame, which is 1⅝ x 2½ inches in the over-all dimensions of its cross-section. Both the frame and strips are cored for lightness. The combination is held up to the balance plate by four helical springs, made of German silver wire 0.125 inch diameter. It is seen that the balance strips have a very deep bearing between the valve and frame, and since the strips are carried by the frame, there must be a constant depth of support to them on the outside face, no matter how much wear takes place, nor what the lift of the springs. This condition of things tends to reduce the liability of cocked or broken strips, as has been found in service. The springs placed at the ends of the frame would seem to exert a more equable pressure on all the strips than is possible with a long spring under each individual strip, for the reason that it is a delicate undertaking to attempt to make four flat springs of the same degree of elasticity. On these grounds it is not unreasonable to expect a continuance of the good results so far shown by this style of valve balance. The dimensions shown are from a ten-wheeler.



BARNES BALANCED VALVE.

Driving Box Brasses.

It is a fact patent to every locomotive man that the driving box brass of the shell type is open to improvement in design, it being of a weak and flimsy character at the front and back sides; that is, the lower surface of the shell, which at best has an effective bearing only to the center of the journal, and withal so thin as to be practically of no value when considering the remainder or crown part of the brass. This is shown by the facility with which it gets loose in the box, and the lesson conveyed is, that the brass has not a proper thickness to resist the stresses transmitted through the cylinders.

Heat will also produce a distortion of the brass, causing it to leave the walls of the box, but the terrible blows received from the journal, augmented as wear takes place, is the main cause of disturbance, and one that should be provided for by more metal. A brass made in three sections, one at the crown and at each side, was introduced many years ago, and is still used on some roads, to overcome the weakness under discussion. The advantage of such brasses is, that they are dovetailed into the box, and can be fitted so as to stay, owing to the shape of the bearing surface.

We note from the *Railway Herald* that the Grand Central Belge Railway has been using, for some time, a brass formed of three sections, top and one at each side, the top section carrying the static load, and the sides, which are adjustable, taking care of the horizontal thrust. The adjustment for wear on the side sections is made by a wedge between one of the sections and the box. This method of keeping brasses in service after they have repeatedly reached the "pound" stage appears to have been very successful, and there is no good reason why it should not be so on locomotives, if correctly designed.

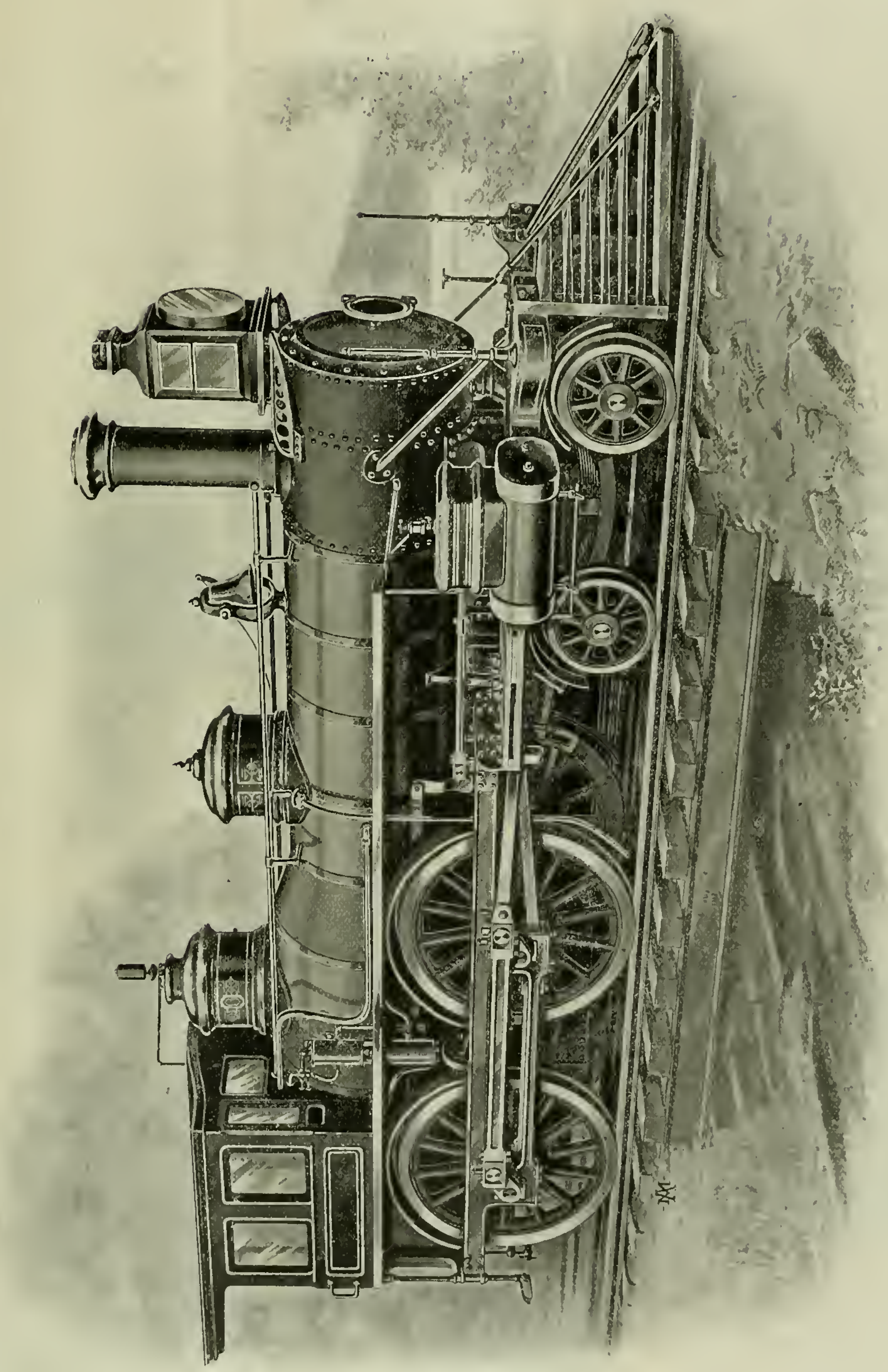
Fads and Fancies—No. 7.

The hammer blow scare was responsible for the subject of our chart this month, which will be remembered by many as the much-talked-of "Shaw" locomotive, which astonished the natives in many places and broke crank pins with surprising regularity.

The design, including many of the details is almost identical with the locomotive built by Haswell in Vienna, Austria, in 1861, and if there were any improvements they are not visible and did not develop in practice.

Probably most railway officials remember the fervent appeals of Mr. William E. Lockwood in behalf of this engine, and the persistency with which he advocated its merits, dwelling on the imminent danger of the hammer blow, and cannot help admiring the energy which was wasted in a hopeless cause. That it is balanced none will deny, and the same may be said of the "Strong" compound, but few are sufficiently alarmed about the hammer blow to wish to add features ten times as bad.

The Shelby Steel Tube Company have received another contract from the United States Government for boiler tubes. These are for the boilers of the new torpedo boats which are now under construction.



FADS AND FANCIES IN LOCOMOTIVE BUILDING, No. 7.

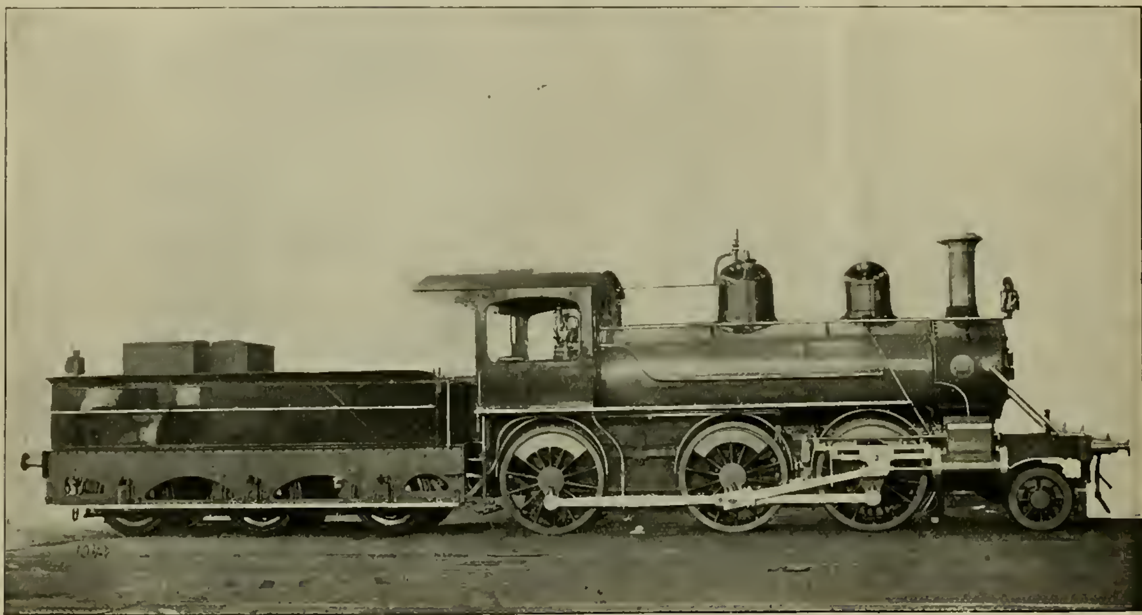
THE "SHAW" ANTI-HAMMER BLOW ENGINE, 1881.

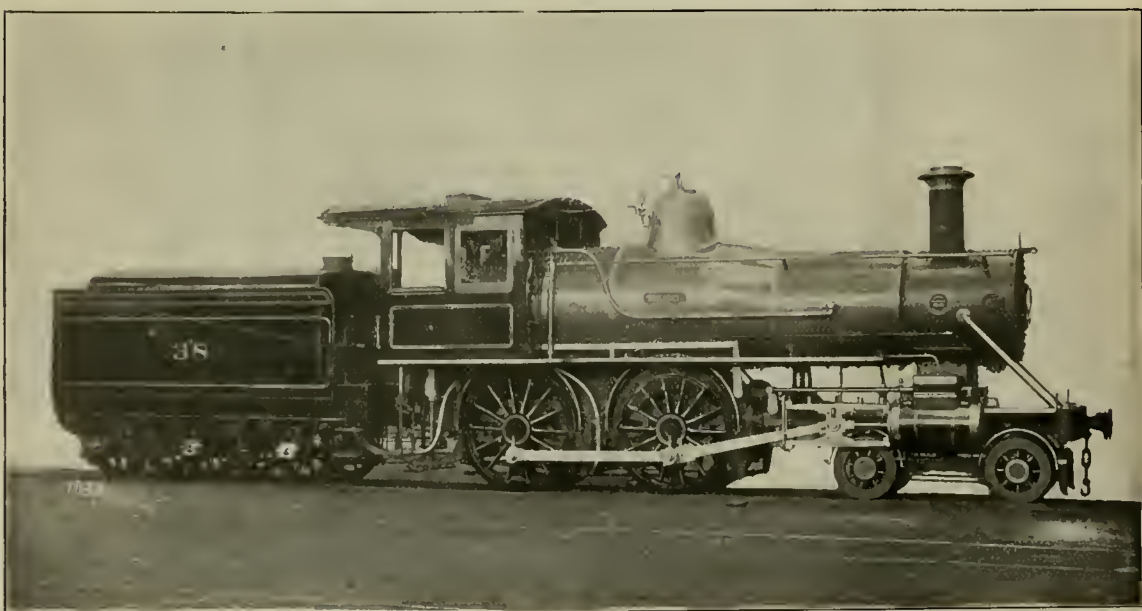
American Locomotives for Egypt.

The two locomotives hereby shown are representatives of two orders recently filled by the Baldwin Locomotive Works for the Egyptian Government. The Government was in a great hurry for the lot of 8-wheel engines which were for use in the railway extension to the Soudan, and the order was placed in the United States because it would be filled much more quickly than it could be done by any locomotive building firm elsewhere. The engines were delivered on shipboard four weeks after the order was received.

The 8-wheel engine is for a 42-inch gage road and has cylinders 15 x 24 inches; drivers 60 inches diameter. The weight is about 73,000 pounds; the boiler is 48 inches diameter and has 163 2-inch tubes. The engine is almost wholly of the American type, but the tender has a mixture of American and European features.

The mogul engine was built for a road of standard gage and has cylinders 18 x 24 inches; drivers 60¼ inches diameter; the weight of the engine is about 100,000 pounds. It will be noticed that the tender is of the usual European style, and the steel cab has a somewhat familiar look.





LOCOMOTIVES FOR EGYPT.

"A Modern Blacksmith Shop" is the title of an illustrated pamphlet recently issued by the Buffalo Forge Company, Buffalo, N. Y. It is profusely illustrated with tools for blacksmiths, and has a half-tone picture of what has been spoken of as a palatial blacksmith shop. Blacksmiths will find the pamphlet a valuable acquisition to their collection of reference matter.

ERECTING SHOP—SORMOVO LOCOMOTIVE WORKS.

Some Shop Improvements.

In the Wilmington shops of the Philadelphia, Wilmington & Baltimore Railroad, we recently saw some evidence of a disposition to stay in the front rank of correct shop management, which, reduced to its lowest terms, means simply to do work on mechanical lines, and furnish facilities so it can be done. There is perhaps a greater variety of work handled in this shop than in the average railroad shop—that is, work not coming strictly within the scope of what is known as locomotive work. Among examples of this versatility in shop practice may be mentioned a large armature undergoing a rewinding, also a 15-foot exhaust fan for clearing a tunnel on the line, of smoke and gases. This shop has for years been noted for its high order of work of which the dynagraph car of the Pennsylvania Railroad is a sample.

One of the recent improvements is the placing of the tool-room equipment on a raised platform or balcony at one end of the machine shop, access to which is by means of a cast-iron spiral stairway. Included among the tools is a tool grinder which has been improved by making the vertical movement of the tool head over the face of the grinding wheel entirely automatic. This was accomplished by removing the hand lever used for the purpose, and replacing it with a crank motion to actuate the head, largely increasing the efficiency of the machine.

The tool room is directly under this balcony, which made necessary some convenient device for elevating and lowering tools between the repair point and place of storage. A little elevator operated with air was devised for this purpose, consisting of a 4-inch pipe extending from the floor, on which travels a small table or tray that is guided by three wheels; the pipe forming the guide as well as cylinder. A piston fitting the pipe is connected to the elevator table by means of a steel cable which passes over a sheave at the top of the pipe. The piston is weighted, and in operation an application of air forces it up, thus lowering the elevator; while exhausting the air from under the piston allows it to drop by gravity and raise the elevator with its load, which is always less than the counterweighted piston. This arrangement of raising and lowering is seen to be directly opposite to the general conception of such devices.

A system of heating feed water and supplying the shop boilers is in successful use here, in which the exhaust system from the shop engine and also from the air compressors is taken to a series of heaters located directly in front of the boiler battery. On top of these heaters are located small steam pumps, and these are handled from the firebox end of the boilers by a rod attachment to the pump throttle, making one of the most convenient arrangements for the purpose of boiler supply imaginable. In addition to these pumps, there are injectors for emergency use. Connected with this boiler plant is another good thing, consisting of four vertically arranged pipes, fitted with standard pop-valve connections, on which all pops are tested and set. There is one other improvement which Master Mechanic Turner did not have to call to our attention, namely, an office for his foreman, located centrally among the tools, and surrounded with glass, so that he can see and be seen—a place where the foreman can keep a record of his stewardship in such a form as to facilitate business in a businesslike way. It caused our mind to turn back to a desk in a dark corner or one nailed up to a greasy post, and also to the great number of foremen that are yet made to carry their office in their hat, but are sustained by the hope that they may live long enough to reach the dignity of a desk placed anywhere.

ANOTHER VIEW, WITH FIRST ENGINE UNDER WAY.

During the great strike a few years ago among the employés of the North British Railway much difficulty was experienced in finding qualified engine drivers. Upon one occasion a young fellow was put upon a section in Fife. One day he ran some distance past a station, and upon putting back he went as far the other way. The station master, seeing him preparing for another attempt, to the great amusement of the passengers on the platform, shouted: "Just bide whaur ye are, Tummas. We'll shift the station!"—*Tid Bits.*

Don't spend all your spare time reading "War Extras"; get a few good books to read between times.

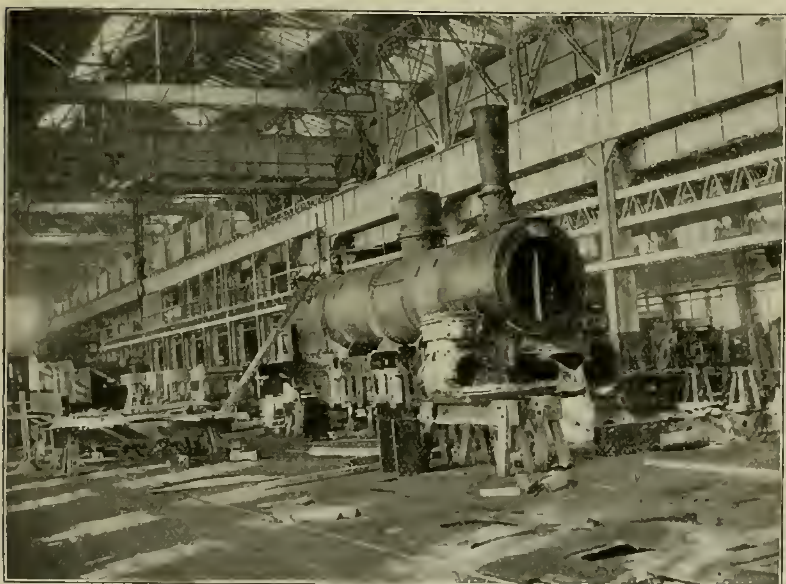
The Sormovo Locomotive Works.

The Sormovo Works are interesting to Americans, as representing the planting of American ideas in locomotive building on Russian soil and the installing of many American tools for this purpose.

Two of Mr. Walter F. Dixon's assistants, F. M. Stevens and his son, have from time to time favored us with photographs and details of their work, and now send us a series of photographs showing in a graphic manner the growth of the plant, from the walls of the first building to the first locomotive which has been turned out. These show that in about twenty months from the breaking of ground for the works the first engine was ready for testing, which was only seventeen months after the tools were shipped from America.

The pictures show an interesting story of progress, and we reproduce five of them illustrating the first engine in the erecting shop; the erecting shop later, or with more work in sight; still another view of the erecting tracks with our friend Mr. F. M. Stevens on deck; the first engine under steam and ready for the test, and a group of Russian officials seated on one of the big boring mills. Even government officials cannot always resist the temptation to cast an eye at the camera, as can be seen by the gentleman on the right.

RUSSIAN OFFICIALS.



THE FIRST BORN.

The accompanying letter from the United States minister to St. Petersburg may also be interesting as recognizing the work done by Mr. Dixon and his assistants in establishing this plant:

[COPY.]

Embassy of the United States,
St. Petersburg, April 8, 1898.

Mr. Walter F. Dixon, Chief Engineer of Sormovo Works, Nijni-Novgorod:

Dear Sir—I am in receipt of your gratifying telegram announcing that the first Russian standard locomotive built in Russia with American machinery and under American superintendence has made its trial trip successfully.

In congratulating you upon the successful result of this first attempt to introduce into Russia American methods in the construction of machinery of this sort, I beg you also to convey to the officers of your company the expression of my satisfaction that the first fruit of this conjoint Russian-American enterprise proves the practicability of the harmonious union of Russian and American labor. I sincerely trust that this may be but the harbinger of a close and widely extended industrial alliance between our two countries, already so full of warm sympathy for each other, the promotion of which the President has deeply at heart. I am, dear sir, your obedient servant.

(Signed)

ELTHAN A. HITCHCOCK.

READY FOR THE TEST.

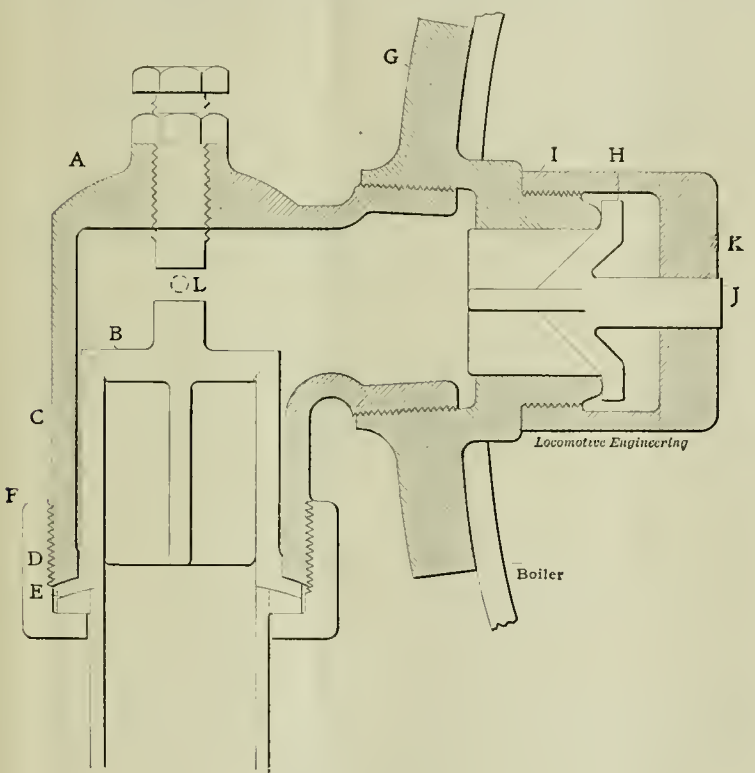
Practical Letters from Practical Men.

All letters in this Department must have name of author attached.

A New Check Valve.

Editors:

I enclose sketch of a possible something new in checks. *A* is the outside valve case, *B* is the outside valve, *C* is the movable valve seat, making a joint on the lower part of the valve case at *D* and on the end or flange of the check pipe at *E;* all being held in place by the usual nut *F*. *G* is a flange (bolted to boiler in the usual way) and with an extension into the boiler, making a seat for the inside valve *H*, which is



A CHECK VALVE.

an ordinary four-winged valve with a round stem *J*, which passes through the guide *K* to preserve the alignment of the valve. The inside cuts no figure in general service, and only comes into service in case the outside case is carried away in a wreck, or when it is desirable to work on the outside check, when the engine is under steam. If at any time it is desired to remove the outside check valve for repairs, and there is pressure on the boiler, there is a small globe valve (not shown) screwed into the valve case at the dotted circle *L*. This globe valve should be opened suddenly, allowing any steam or water in the check case to escape, also telling us whether or not the inside valve is seated. The opening of the globe valve is a precautionary measure, before any attempt is made to loosen the check-pipe nut *F*. You will notice that the outside valve seat is not a part of the valve case, but inserted.

We don't have to unscrew the top of the valve case and try to fish out the valve, as in general practice. The set screw shown is to regulate the lift of the valve, if thought best. It will be further noticed that the seat of the inside valve is rounding; it is made so that, in case of an emergency, the valve may crush through any scale that may be on the seat. No, it is not patented. Use it.

W. DE SANNO.

Vallejo, Cal.

Full versus Partial Throttle.

Editors:

It appears to me that E. L. Rauch, June issue, does not, intentionally perhaps, touch the salient point of the question of wide open or partially closed throttle in its relation to the economy of coal consumption; either that or I do not understand the question. I assume the question to be whether, so far as economy of coal consumption goes, it is better that "you have hooked up your lever as far as will do the work," etc., or dropped it down where the engine will do somewhat more work and throttled a little for the purpose of throttling; throttled by design, and not by accident or for convenience. This is a question not so well settled in stationary or locomotive practice as it ought to be.

In the instance of stationary engine practice, it presents a problem that would probably have been solved before this, had it not been for the advent of the automatic cut-off engine. The craze—a rather natural one—for automatic regulation, pure and simple, led its advocates, and leads them to-day, to tolerate nothing to which the appellation of throttling can be applied. Along with advantages that can be most justly claimed for automatic cut-off, it would be more than strange if some claims of a negative character were not made for it. For an automatic cut-off engine, with a given steam pressure, there is an uncertain—or at least not very certain—most economical point of cut-off; a point below which it is the reverse of economical to carry expansion. Speaking of pressures ordinarily employed, say this point is at quarter stroke; but if the load remains constant and the steam pressure is increased, there will be a gain in economy, notwithstanding expansion has been carried too far. The gain from higher steam pressure more than balances the loss from too short cut-off. Why this is so is a point not as clearly shown as is desirable. Just how, under the circumstances has higher steam pressure wrought for superior economy? It can be readily enough seen that if along with increased steam pressure had gone a corresponding increase in load, resulting in substantially the same terminal pressure as in the instance of the lower pressure, a unit of work would have been done at less cost than when the lower pressure was employed; but why it is done at less cost, notwithstanding the loss from too low expansion, is not so plain. Mind I do not say that it cannot be explained, but that the reason is not so apparent. And this brings forward the question of whether or not, in locomotive practice, when the work can be done at short cut-off—or at any cut-off—it is better to extend the point of suppression and throttle down. The question is, if in the instance just cited the higher pressure is throttled down so that the terminal pressure is about the same as when the lower pressure is employed, the economy would not be still better. While the difference in conditions, constructive and operative, would make the effect different in degree as between a stationary and a locomotive engine, the difference would be the same in kind. An exact test is wanted; a test, I should think, could be made with the experimental locomotive at Purdue University that would settle the whole matter.

I remember at one time, more than thirty years ago, in conversation with a very observing locomotive engineer, he took a decided stand, in substance, that there was no economy in cutting off much, if any, earlier than one-third stroke. I believed to the contrary, and to settle the matter for ourselves and for that engine, we put two new notches in the quadrant of his engine, the one for a cut-off at a little earlier than one-quarter stroke, and the other for a cut-off at a little earlier than one-third stroke. His train was such that the run could, for the most part, be made at the shorter cut-off. We tried the run one day my way, which was with full throttle as much as possible, and the next day his way, which was to throttle practically all the time. While there were no very fine lines about the test, if you could dignify it by that term, we both agreed that I was beaten, he quite emphatically, and I not quite so much so. At the time I attributed the discomfiture of a full throttle to other causes, but I have been growing less certain of my ground for doing so ever since. The steam pressure was that rather common to the time, viz., 125 pounds.

F. F. Hemenway.

New York.

Broken Spring Hangers.

Editors:

I read the paragraph in your May number (page 227) about the Japanese engineers who were wise after the event, and showed beyond doubt that there was nothing left for that hanger to do but break. I have a great respect for Japanese engineers, as, in fact everyone must have who likes to see people trying to lift themselves out of a rut and "get a gait on them." But I guess they are hardly qualified just yet to sit in judgment on Uncle Sam in the matter of locomotive designs. They have doubtless studied the subject tremendously, and know about all that is to be learned in that direction second-hand, at least so far as we've gone.

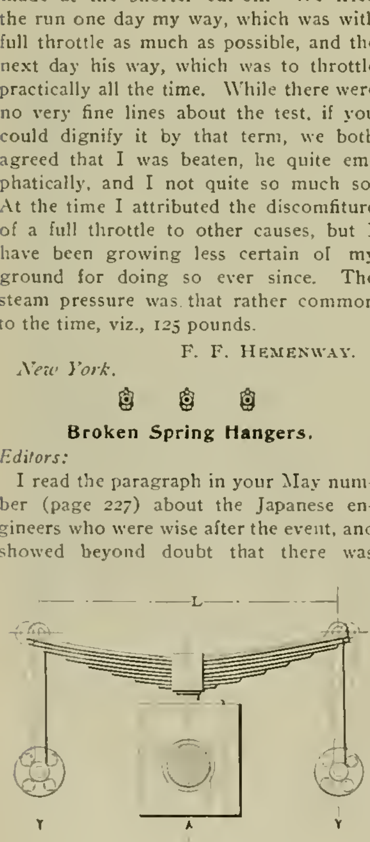


Fig. 1

When, in addition to this praiseworthy feature, they have had about twenty years' experience building locomotives themselves, we shall be ready to listen to them. Have often run across these young Japs in England, where they go to the various railroad works for a term of pupilage, as is also the case here, at Baldwin's and other firms. My chief recollection of them is that they were extremely mathematical and very enquiring. But it's no good blinking the fact that all the books and colleges in the world won't teach a man to design a locomotive. Knowledge of this kind, however, coupled on to a wholesome dose of practical experience, is what goes. I say this, bearing in mind the good work that has been done at Purdue, etc. Working along those lines, the investigators will always, and gladly, be listened to. There are many points that can be experimented on and well observed in the laboratory. Railroad men are indebted to Professor Goss and the Purdue plant for many things; but if he were to begin and tell them that they make their main and side rods too heavy (not but what they often do) or their motion pins too large (or the reverse), or put too few cylinder studs in—but there, he wouldn't!

The part of your paragraph that struck me particularly was where the engineer in question "concluded that the factor of safety was too low." Well, in a sense, that's certainly hard to gainsay, as regards that particular hanger. But it by no means follows that the hangers, taking the general design, were not big enough, or else more of them would have broken. Consider the number of things affecting the question. This particular hanger might have been of inferior iron, or have been in the fire a little too long, or—something else. Thus, if it were defective in any such way, of course the safety factor was too low, for the safety factor is supposed to take into account everything, those contingencies which we know to exist, but cannot exactly estimate, being liberally allowed for. It would be interesting to see this gentleman's calculations. I don't believe the hanger was too weak, or, at least, that it had too little metal in it. We don't often err over here in that direction, as you will doubtless concede.

I am reminded of something in this direction that occurred in my own work many years ago. Had designed some locomotive spring hangers, as in annexed sketch, Fig. 1. There was to be about 8,000 pounds on each spring. I made the hanger 1⅛ inch in diameter. Now, a spring hanger has to carry about as live a load as one could well imagine, especially on a bad road, and with no equalizing gear; so, although the fact of its being a spring hanger is in its favor (for the shocks are mitigated by the elasticity of the spring), still it's as well to allow a nominally low working load. The hanger here shown had about 4,000 pounds per square inch, static load. The ultimate tensile strength of the iron was about 52,000, giving an apparent safety factor of 13. (As a matter of fact, I always like to figure on the elastic limit; that's the right thing to go by. But I bow to common usage, and give the safety factor as 13, for the sake of comparison.) Well, soon after these engines were put on the road a couple of them broke, at *a*, Fig. 2. The Chief tackled me on the question, and advised making them 1¼ inch. I was loath

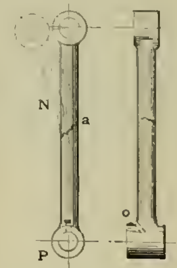


Fig. 2

to do this, as I felt sure it was not merely a matter of insufficient metal. A margin of 13 ought to stand anything met with in a locomotive. As far as could be seen from the fracture (which was oily and dirty), the iron was good. Noticing, however, that the fracture ran in the direction shown, I sent over for the lower part of hanger, and then found it had been fast on the pin *P*. The hole showed that; it was clogged up all dry and rusty, and had to be forced off, as was easily seen from its appearance. The oil hole was bunged up, as holes in spring and brake gear, etc., generally are. What had happened seems clear enough. As the engine rides up and down on her springs, the latter straighten out, and therefore the distance between centers—*L*, Fig. 1—keeps continually lengthening and shortening; thus the hangers have to move back and forth laterally, as shown dotted in Fig 1. (The amount is exaggerated for clearness.) Now, in the case in question the hanger couldn't work on the pin *P*, as the joint had stuck fast, so the only thing left for it to do was to work within itself, as shown exaggerated at *N*. This continual "come and go" had evidently at last caused it to fail.

Well, the Chief stuck out for 1¼ inches, so there was no more to say. I at the same time, however, suggested the propriety of giving the oil holes *o* a chance to fulfil their natural function.

Now, the above may or may not have been the cause of failure. It certainly seemed not unlikely, although, of course, the side motion of the hangers was much less than shown in the sketch, the total variation of *L* being about 9-16 inch. Assuming, however, the cause of failure to have been as shown, or at least mainly contributory thereto, the incident may serve to remind some of your younger readers engaged in design that it by no means suffices to know merely the dead or static load. If we were concerned only with computable stresses we could soon fix matters and go on our way rejoicing; but there is more to be considered than merely the strength of the piece under the steady pull of a testing machine, and the dead load estimated to come upon it. The case in point shows how mere calculation may sometimes fall short of what is required. The scientific enquirer or theorist can deal all right with known data; but there are also the unknown data—those not on the surface—that call for recognition. Information on this head is not, as a rule, to be found in books, at least not those written by arm-chair engineers. Where books are put together by men who have been through the mill (and locomotive literature in this country happens to be well off in this respect), they are invaluable, especially to those who have rubbed shoulders with actual working conditions, and therefore see at once what is meant. To them a hint is sufficient; they know right away what the writer is driving at. A couple of lines puts them on the right track, which they are not slow to follow up; whereas a whole page wouldn't do as much for the uninitiated. It has always seemed to me that books are really most suitable for, and can be made best use of by, men who have already learned something of the subject first-hand. You needn't be afraid of injecting too much theory into a man who has a lot of practical experience to keep him straight. He's not likely to go off on false tracks. He can always pick out the wheat from the chaff; he won't waste his time in running after false gods, as book-learned men often do.

In conclusion, should like to say a word about the "if it breaks, make it bigger" type of engineer—a class now getting rarer, let us hope. Whenever a breakage occurs, there's a reason for it. It's a wholesome practice to persist in reminding oneself of that truth. There's a reason for every action and every failure, no matter how apparently inexplicable. The right thing to do is to search diligently for it, and not, as is often done, seek refuge in a reckless piling on of the metal; that's only one way out of it. If what seems likely to be the cause is found, but cannot be eliminated or mitigated, there's nothing for it but to make the part larger.

An analogous case to the spring hanger here considered, seems to me to be that of the staybolt. If we had only the pull due to the steam pressure to consider, our path would be one of roses. But there is the continual bending due to the relative motion of the firebox and outer shell, caused by variations of temperature. This, combined with the direct stresses, is what does the damage. The man who goes to work and figures only on the direct pull is likely to get left. Of course in the majority of cases this is done, and no harm results; but that is simply because the margin of safety as against the direct pull (10 or 12, as a rule) is drawn upon, and thus keeps matters straight. But he who is aware only of the direct stress is in the same boat with him who only thinks of the static load on a spring; they've both something to learn, and sooner or later will design things that'll "bust up."

H. Rolfe.

Scranton, Pa.

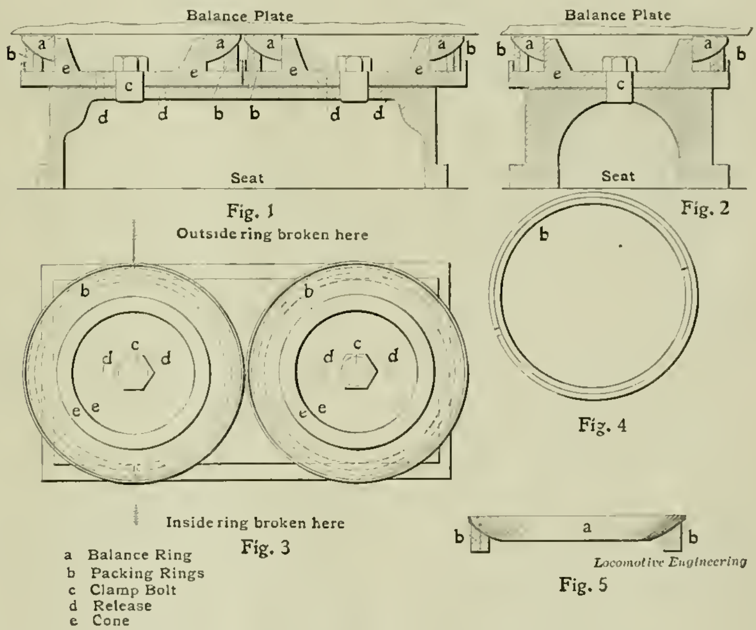
Briggs Balanced Slide Valve.

Editors:

As I am a reader of your interesting paper, and have been for the past ten years, I have seen a great deal published in your paper about balance valves. I herewith enclose a blueprint of my balance valve. You can very readily see that it will require very little explanation as to the operation of this improved balance. This balance consists of four parts—cone *E*, two packing rings *B* and joint ring *A*. The packing rings are cut as shown in Fig. 4. To break the joints these rings are pinned together. To prevent the cuts working around, they are also ground on cone *E*, to prevent any leak at bottom of packing ring. They have a ball joint on top with joint ring *A* perfectly ground to them. Joint ring *A* is a nice, neat fit on cone *E*. Now you can very readily see that it is impossible for this valve to blow, as the greater the steam pressure on the outside of packing rings *B* the tighter ring *A* will be on balance plate. I give these rings only 1-32 inch compression. I have this valve in one of our engines, and she is as tight as a corked-up bottle. Another advantage this balance has—it balances to outside diameter of outside packing ring *B*. I hope this will be of interest to the readers of Locomotive Engineering. If anyone has any criticism of this valve to make, I should like to hear it.

R. H. Briggs, Jr.

Amory, Miss.



BRIGGS BALANCED SLIDE VALVE.

Air and Electricity in Shops.

That both compressed air and electricity have their place in shop work is shown in the Brooks Locomotive Works, at Dunkirk, N. Y. Here there is a good power plant of both kinds; the electric powerhouse furnishes light, power for the transfer table, and also power for many of the large tools which are independently driven.

The other power-house adjoins the first, and contains two compressors, one being an Ingersoll-Sergeant, of the compound type. In the same house is also the hydraulic pump for the riveters and flanging machines. The air is used for hoists, pneumatic chipping hammers and drills, for tapping and putting in staybolts, as well as for blowing up bicycle tires. The two, or rather three, forms of power transmission work in perfect harmony, and each seems to have its particular field, which can of course be widened to take in other work if thought best.

It is to be regretted that shops generally do not use compressed air more extensively, for in hammers, drills, etc., it is a particularly convenient power, and also helps the atmosphere of the shop by its exhaust. To some extent the same can be said of electricity for small powers, for it is very easy to run wires anywhere in the shop or yard The atmosphere is not affected, of course, as with air.

LOCOMOTIVE ENGINEERING
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Mediation and Conciliation.

A measure has just passed Congress, called "An act concerning carriers engaged in interstate commerce and their employés," which appears calculated to exert a powerful influence between railroad companies and their trainmen. It provides that the chairman of the Interstate Commerce Commission and the Commissioner of Labor shall form a board of mediation and conciliation, to which all disputes between trainmen and their employers shall be referred for settlement. If this board has difficulty in effecting a settlement, they may appoint another board, to consist of one person nominated by the employés, one by the railroad company and one chosen by these two. If the representatives of the employés and the railroad company should fail to agree in the selection of a third member, he may be appointed by the first board, viz., the chairman of the Interstate Commerce Commission and the Commissioner of Labor. The first board is called a Board of Mediation and Conciliation, which describes the functions given to them. The board of three is called a Board of Arbitration, and is intended to effect a settlement of disputes that mediation and conciliation have failed to straighten out.

When the Board of Arbitration makes a settlement of any case, it will go in force for one year; but if the employés represented are dissatisfied, they can enter an appeal within ten days, and the railway company has the same privilege. As soon as a decision is made it will be in force for one year, and trainmen are prohibited from quitting the services of the company within three months after the decision goes into force without giving thirty days' notice. Railroad companies, on the other hand, are prohibited from discharging men within the same period because the companies are dissatisfied with the settlement.

If the arbitration has been entered into at the request of one or more railroad organizations, employés who are not members of the labor organizations will not be bound by the agreement unless they have previously intimated that they will be guided by the decision.

During the pendency of arbitration it shall not be lawful for the employer, party to such arbitration, to discharge the employés, party thereto, except for inefficiency, violation of law or neglect of duty; nor for the organization representing such employés to order, aid or abet strikes against their employer, nor will it be lawful for a period of three months after the settlement for an employer to discharge any employés, except for the causes mentioned, without giving thirty days' notice of an intent to do so.

Under the act railroad companies or their officers are prohibited, under penalties, from using their influence or power to prevent employés from joining or remaining members of any labor organization. The companies are also prohibited from requiring employés to enter into a contract whereby they shall agree to contribute to any fund for charitable, social or beneficial purposes, to release such employer from legal liability for any personal injury by reason of any benefit received from such fund beyond the proportion of the benefit arising from the employer's contribution to such fund. In short, all railroad companies are prohibited by law from requiring employés to contract away their right of compensation for damages in case of accident. Black-listing of employés, or the doing of anything to prevent them from obtaining employment, is forbidden. The penalty for violating any of the provisions of the act is a fine not less than $100 and not more than $1,000 for each offence.

It seems to us that this is a measure of extraordinary importance which has become a law very quietly. It appears to effect a revolution in the position of railroad trainmen, as far as their means of embarrassing their employers is concerned. Under this law, peaceful strikers are lawbreakers, and are liable to be sent to jail unless they have given thirty days' notice of their intention to strike. Think of a squad of dissatisfied switchmen giving thirty days' notice of their intention to strike! We have always been believers in mediation and conciliation as a means of settling trade disputes, and this law may prove a benefit and a blessing to all concerned, but time will be required to demonstrate its value.

Coal Inspectors.

A few railroad companies have recently appointed officials called "coal inspectors," some of whom had a variety of duties assigned to them, while in other cases the officials devoted themselves entirely to watching the character of the coal supplied for the company's use. If an official of this character performs his duties faithfully, he is likely to effect very important savings for his employers. There is no line of goods sold where cheating by adulteration can be performed so successfully as with coal. All kinds of coal have earthy or rocky properties in them when mined, and it is the duty of the owners of mines to see that the impurities are taken away before the coal is put upon the market, but this is sometimes very indifferently done.

A report recently prepared by an expert for the Mutual Boiler Insurance Company, of Boston, says: "The earthy matter or ash in coal is worse than useless for fuel purposes, since it not only adds to the cost of handling the coal before it is fired, and increases the expense for labor in firing and cleaning fires, but in addition the earthy matter causes the loss of good coal when cleaning fires.

"The amount of earthy matter in coal depends chiefly on the care with which the coal is mined and prepared for market. Anthracite coal, for instance, as found in the ground, contains from 18 to 28 per cent., and occasionally much more. Most of this is removed when preparing for market, so that anthracite, as sold, may contain as little as 3 per cent., while as high as 46 per cent. has been found on boiler tests. Soft coal is usually purer than anthracite, both in the ground and also when brought to market, but the amount in any particular case depends on the care taken in mining and preparing for market. The tests made by the Steam Users' Association showed the refuse in boiler tests on Pocahontas coal to vary from 1½ per cent. to 10 per cent."

Pocahontas coal is as free from impurities as any coal mined, yet the investigation showed that it sometimes contained 10 per cent. of incombustible matter. A great many varieties of Western coal contain a very large percentage of impurities when taken out of the mines, and in many cases it has been given to railroad companies without the least attempt being made to take out the impurities. The quality of coal received has always been under too little supervision, the consequence being that bad steaming coal was a continual source of complaint, the real trouble being that the supply contained a great deal of matter which had no heat-generating qualities. This is a subject that is firmly deserving of attention from railroad managers. If they have not test departments capable of finding out the quality of the coal, they should send samples to a testing bureau, such as The Robert W. Hunt & Co. Bureau of Inspection, Chicago, Ill., and if the bureau finds that the coal is high in incombustible matter, the company would find it to their advantage to employ a coal inspector.

Inferior Boiler Covering.

The work done by the advocates of good non-conducting covering for boilers and other surfaces which waste heat when left exposed, is gaining converts slowly; but inferior boiler covering is still much too common. It is very hard to convince some men that waste of heat is going on when they have no means of measuring it. A safety valve blowing hard appeals to most men as direct waste of coal, because they know how quickly a boilerful of water can be blown out of the safety valves; but when it comes to forming an idea of how much heat goes uselessly into the atmosphere, through inadequate boiler and cylinder covering, they are entirely at sea.

The Mutual Boiler Insurance Company, of Boston, had a series of experiments made a short time ago to ascertain the effects of different forms of steam pipe covering which brought to light facts that are good thought food for every person interested in preventing the loss of heat from boilers as well as from steam pipes. The work was done by Professor Norton, of the Massachusetts Institute of Technology, and was performed in a highly practical and ingenious manner. The tests of waste due to boilers and steam pipes being badly protected from radiation, used to have too much of the guessing element in them to obtain the respect of engineers, but heating by electricity has provided a means of heat measurement that can be made absolutely accurate. The apparatus used for testing is thus described by Professor Norton:

"A piece of 4-inch steam pipe, 18 inches long, is closed at one end by a plate welded in and at the other by a tightly fitting cover. This pipe is then filled with cylinder oil, and a coil of wire of sufficient carrying capacity and a stirrer are introduced into the oil. A thermometer is inserted in such a position as to record the temperature of the oil. An ammeter and voltmeter or a wattmeter may then be connected so as to record the amount of electrical energy supplied. The stirring must be brisk, and if enough power is put into the stirrer to be comparable with the electrical energy supplied, such amount must of course be added, as it also is converted into heat. It is my custom to suspend the apparatus in the middle of the room on non-conducting cords, and read the thermometer with a telescope, so that no heat from the person of the observer may be added to the supply given to the cover from within, and also that care may be taken not to produce air currents by walking near the apparatus during a test."

The electrical current was turned on and the apparatus raised to a certain high temperature; the amount of heat necessary to keep up the temperature of the bare pipe for thirty minutes. The different kinds of covering to be tested were then applied to the pipe, their efficiency being reckoned from the reduced quantity of heat required for keeping the pipe at the testing temperature, which represented the heat of steam of 200 pounds pressure. The loss of heat from the bare pipe was found to be 13.84 heat units per minute for each square foot of surface exposed. Tests were made with fourteen kinds of covering, and it was found that the loss of heat by radiation varied from 2.2 to 3.61 heat units per square foot of surface. All except three of the coverings kept the loss below 3 heat units.

As badly covered locomotive boilers permit a current of cold air to be constantly passing over the hot sheets, it is easy to understand the great amount of heat carried away. Between wood lagging and good air-tight non-conducting material, the difference in first cost is very small compared with the difference in utility, and it is surprising that any master mechanic should continue to use the inferior material, with all the information available concerning the waste it causes.

About Springs.

A few brief weeks ago we had a call from our long-time friend, Mr. John Kirby, the veteran master car builder. One of those calls that are reminiscent always, and turn time back long enough to enable us to get a fresh hold on the present. In the course of conversation the subject of springs was touched on in a very interesting way by Mr. Kirby, who detailed some experience covering years that most men in railroad business cannot count. Rubber was the medium used in the early days, and rubber with elliptics and also in combination with helical springs was in evidence during the middle period when equipment was increasing in capacity but slowly. The lesson of elasticity conveyed by the old rubber spring has been lost sight of, apparently, in the present provision for heavy cars, the tendency being too often in the direction of a spring with too great rigidity, on the supposition that the latter quality is the one to be cultivated in order to sustain the load. This, it will be observed, effectually puts the idea of elasticity in the background, and places a spring at a disadvantage at the start.

Springs built on the rigid order are invariably weak from a superabundance of stiffness. In the case of elliptic springs, thin plates of a number sufficient to carry the load, are always preferable to thick ones, and so, too, with helical springs; a number of small bar coils will give a greater elasticity than one large bar coil, and therefore will have a longer life than the stiff spring.

There is some little food for thought in these views of a man whose opinion is not to be taken lightly, for it is the condensed result of most valuable experience. We are reminded of a somewhat similar case of rigidity in double elliptic springs that once caused us a period of unrest, but the weakness was due in the latter case to the distribution of metal in the springs. The plates were all of ⅜ x 4-inch steel, except the lower ones, which were 7-16 inch thick, and the thick plate invariably failed. By substituting a ⅜-inch plate for the thick one, making all plates of the same thickness, no further trouble was had from the springs.

Metal Railway Ties.

A period of sixteen years covers the time since metal ties were introduced on the St. Gothard Railway, which has gone into iron or steel ties in a more extensive way, probably, than any other railway, having 71 per cent. of its main line equipped with them. These ties are expensive in first cost, the price of a mild-steel tie weighing 193 pounds being $1.98. But first cost cannot present a very appalling aspect to the purchaser when life of the tie is considered, or when viewed from the standpoint of maintenance, since permanent way is found to be kept up at a much less outlay with metal ties than when wooden ones are used.

There is a good reason why the metal tie should be labored with in the case under consideration, namely, the cost, the price being about equal to that for the oak tie, which is quite enough to prohibit the use of wood, as it would be certain to do in this country if quoted at $1.98 per tie. Carefully kept records show the metal tie to be more economical to use. It has been demonstrated that their life is practically the same as the rails they support, except in tunnels, and even in those situations they last longer than the oak tie under the best conditions.

The question of safety is paramount, and if any confidence is to be placed in the figures showing the superiority of metal over wood for ties, we know of railways in this country that would profit by the results if they adopted metal at once. A rotten tie is an invitation to disaster that does not go unheeded very long, as we had an opportunity to note, but a few weeks ago, on a road that makes some pretensions to speed and a healthy general physical condition. A red flag held up the train at a broken rail, the cause of fracture in which was the fact that the rail crossed a tie so far gone with the infirmities of age as to crush under the foot. Vigilance in this case prevented a wreck that would have been charged up to an act of Providence, but for the timely discovery of the break.

Railway Mechanical Conventions.

The annual conventions of the Master Car Builders' and Master Mechanics' Associations were held at Saratoga last month. With railroad clubs all over the country investigating and discussing monthly all conceivable subjects relating to railroad appliances, it is very difficult for the large associations to find anything new to report upon or to discuss, and it was not surprising that the proceedings of the two conventions named consisted mostly of threshing oft-threshed straw.

The principal subjects reported on at the Master Car Builders' Convention were, lumber specifications for freight cars; standard truck for 60,000, 80,000 and 100,000 pounds capacity cars; side bearings, and axles. It goes without saying that the discussions which followed these reports were far from being exciting.

The Master Mechanics' Association wrestled with the subjects, tonnage rating for locomotives; advantage of improved tools for railroad shops; best form of fastening for locomotive cylinders; best method of boiler and cylinder insulation, and efficiency of high steam pressures for locomotives. All these subjects have been repeatedly discussed before in the Master Mechanics' Convention, except the tonnage rating of locomotives. There were a number of fairly live subjects brought out for noon-hour discussions, which imparted some life and interest to the proceedings. The apprentice boy was discussed from a variety of standpoints, the special apprentice and the ordinary apprentice receiving considerable attention.

The standing committee on the apprentice boy submitted a report making certain recommendations as to the work which a boy ought to be permitted to do during his apprenticeship. That led to a somewhat lively discussion which gave the impression that no hard and fast rule can be established for the conduct of the apprentice boy, and that the practice of shops and the disposition of individuals required modifications that no set rules can deal with. In the report on the apprentice boy, the committee recommended that the parents or guardians of apprentices who are minors should give a release from any claim for compensation in case of accident to the minor. We were surprised that this article received no discussion, for the courts have repeatedly held that contracting away one's right for compensation is illegal. A law recently passed, which deals with the relations between trainmen and their employers, specifically makes the attempt of an employer to have his employé contract away his right for compensation to be a misdemeanor.

An incident which created a great deal of talk about the hotels happened in connection with the election of the president of the Master Car Builders' Association. Mr. E. D. Bronner was first vice-president and entitled to be advanced to president, and everyone expected that he would be elected, when he made a public refusal to stand as a candidate. It came out afterwards that a number of the older master car builders went to Mr. Bronner and protested that he had no right to become president of the Master Car Builders' Association, because he is now an assistant superintendent of motive power. This kind of objection has been repeatedly raised among the master car builders, who are now becoming a very small party in the association, and the superintendents of motive power, who are really by far in the majority, are getting tired of it. The incident gave new life to a movement to consolidate the two associations, which is likely to be carried out.

In his annual address President Leeds, of the Master Mechanics' Association, said, that if there ever existed a need for two associations that necessity had passed. The members of either association being eligible for membership in the other, and the duties of research and advancement being not only identical, but to a great extent carried on by members of both associations, the two associations ought to be consolidated for the mutual advantage of the members and the railroads. Of the members of the Master Mechanics' Association who did not appear in the list of the Master Car Builders' membership, a very large majority are master mechanics and have an interest in and control car departments as well as motive power. He expressed the opinion that a much stronger organization could be made out of the two, and that the consolidation would be for the benefit of all concerned. The remarks on this topic appealed so strongly to the members of the Master Mechanics' Association that they appointed a committee to recommend means by which the proposal for association should be carried out, and the executive committee are required to take action. A significant incident in this connection was the election of Mr. A. M. Waitt, one of the leading master car builders, as third vice-president of the Master Mechanics' Association.

Dust Guards.

We note the fact that dust-proof journal boxes still engage the attention of the inventors, and lubrication of same is their handmaiden. It is a fruitful field for the inventive faculty to exercise itself on, and one that is bound to yield returns to the right party with the right device. A peculiarity of the results so far attained is, that they run in grooves so similar that not much progress is apparent on original lines. The capillary feed has an innings in a design lately brought out, in which the lubricant is carried in a separate reservoir in the box and fed to the journal through felt. This is a new application of an old principle tried years ago, but has a dust guard in connection with it, which is formed of soft material that is made to hug the axle, and thus exclude dust, and there is reason to believe that the packing idea will work, since it is forced to the dust-guard bearing by means of a ring which may be made to advance or recede by tapped bolts extending out through the oil box cover. This scheme is new, as far as we know, in dust-guard practice.

A Dust Conveyor.

The whirligig of time makes old things new, and more especially is this true of mechanical devices. One of the very old ideas of preventing dust from gaining entrance to a car by catching it in a conveyor has been galvanized into life once more by way of the patent office. The device consists of a series of tubes with funnel-shaped ends, under the car, and extending through the clear space between trucks. The business of these funnels is to corral all the dust in the neighborhood and pass it back to the rear of the train, and quietly spill it out for ballast. Along in the sixties a similar scheme was in operation on the Michigan Central, by means of a frame covered with canvas, which ran the whole length of the car, and extended from the bottom of sills to within a short distance of the rail, covering the trucks and all parts under the car. It conveyed the dust to the rear of the train all right—that is, that part of it that didn't get into the train at the ends—but finally went the way of all schemes to save putting the roadbed in shape.

Unpunctuality of Trains on Foreign Railways.

In a recent number of Locomotive Engineering there was an item telling about how two men left Cleveland at the same time on trains going to St. Louis, and that they arrived at the end of the journey of 450 miles so closely together that they both got into the same street car on their way to the hotel. That item has been commented on by several English railroad papers, and is used as evidence to show how much more punctual American railway trains are than those in the British Isles. In fact, it has been used as a text on which to preach sermons complaining of the want of punctuality, so common with European trains. In this connection we notice that British engine drivers are blamed for the annoying habit of trains reaching their destination away behind the scheduled time. The statement has been repeated that British enginemen, being paid premiums for coal saving, will not attempt to make up any time that is lost because the extra work would be done at an extra expenditure of coal. If that really militates against the punctuality of trains, it seems to prove bad management on the part of the officials, since it would be an easy matter to arrange that the drivers and firemen should not have their income suffer from making up time that was lost by no fault of theirs.

There may be some foundation for this charge, but from what we have seen of European train operating, we are inclined to believe that the failure to make up time results principally from the locomotives being deficient in power for the work they are expected to do. Compared with first-class American locomotives, nearly all British engines are deficient in steam-making capacity. As the boiler is the real measure of the power of a locomotive, one that is deficient in this respect cannot be made to do work that is beyond its capacity. The British locomotive, with its big driving wheels, is an excellent machine for keeping a light train going at high speed, but when the train is heavy or the wind strong, the power lags on every hill, and time is lost, with the result that the poor engine driver gets the blame.

When a fine design of a car or locomotive comes out of a railroad office it nearly always bears the ear marks of a humble person who holds the position of draftsman or mechanical engineer, but he gets no credit for the work performed. It all goes to the superintendent of motive power. There are some of these officials who are ready to give credit to the real designer, but they are not so numerous as they might be. The man at the head of the department is very often afraid to give credit where credit is due. This is a sign of weakness, for a strong man can well afford to tell something about the help he has had from his subordinates. The fact that a man is smart enough to hire good subordinates is an argument in his favor, but there are too few who look at it in that light.

Those useful implements in case of wreck, the axe and saw, are on many roads located under the sills of the coach, in a box similar to a supply box, but smaller. Whether their location at that place on the car is due to a consideration of the feelings of the passengers, which prompted the removal of all suggestion of disaster, or whether the tools were found to last longer outside, inquiry did not clear up. There are, no doubt, good reasons for the outside idea, but there are occasions when the sight of those tools on the inside would cause hope to chase despair from the breasts of imprisoned unfortunates.

PERSONAL.

Mr. M. S. Curley has been appointed master mechanic of the Illinois Central shops, at Water Valley, Miss.

Mr. C. W. Taylor has been appointed purchasing agent of the Detroit & Lima Northern; headquarters at Detroit, Mich.

Mr. P. Cain has been appointed traveling engineer of the Louisville, Henderson & St. Louis, with headquarters at Cloverport, Ky.

Mr. W. J. Hemphill has been appointed master mechanic of the St. Louis, Peoria & Northern, at Springfield, Ill., vice Mr. A. L. Moler, resigned.

Mr. C. H. Sharman has been appointed superintendent of the Wabash, Chester & Western, at Chester, Ill., succeeding Mr. J. R. Hawkins, resigned.

Mr. A. R. Ponder has been appointed general superintendent of the St. Louis, Kennett & Southern, at Cape Girardeau, Mo., vice Mr. L. B. Houck.

Mr. R. E. Smith, superintendent of motive power of the Atlantic Coast line, has been made general superintendent of that system, with headquarters at Wilmington, N. C.

OFF TO THE CONVENTION.

At the last Master Mechanics' Convention, Messrs. M. N. Forney and E. L. Coster were advanced from the list of associate members to that of honorary members.

General Superintendent C. G. Chevalier, of the Ogdensburg & Lake Champlain, has been appointed purchasing agent, in addition to his other duties; office at Ogdensburg, N. Y.

Mr. John F. Shaughnessey has been appointed purchasing agent of the Minneapolis, St. Paul & Sault Ste. Marie, vice Mr. T. A. Switz, resigned; headquarters, Minneapolis, Minn.

Mr. Herbert Roberts has been appointed superintendent of motive power of the Norfolk & Southern, succeeding Mr. G. R. Joughins, resigned; headquarters at Berkley, Va.

Mr. C. A. Ward has been appointed master mechanic of the Bangor & Portland, with headquarters at Bangor, Pa. He was formerly master mechanic of the Kansas City, Osceola & Southern.

Mr. James McNaughton, superintendent of motive power and cars of the Wisconsin Central, has resigned to accept the position of superintendent of the Brooks Locomotive Works, at Dunkirk, N. Y.

Mr. William Coughlin, division superintendent of the St. Louis Southwestern, at Pine Bluff, Ark., has been promoted to the position of assistant general superintendent, with headquarters at Tyler, Texas.

Mr. W. White, Jr., general foreman of the Illinois Central shops, at Freeport, Ill., has been appointed general foreman of the main shops, south of the Ohio river, of that road; headquarters at Paducah, Ky.

One of the pioneer supply men, Mr. W. B. Mack, well known as the inventor of the Mack injector, has been absent for several years, but he attended at Saratoga. He has a new injector, called the "Torpedo," which he is pushing.

General Superintendent of Motive Power F. D. Casanave has gone to Europe to be absent about three months. He is taking the holiday and change for the benefit of his health, which has been by no means satisfactory for some time.

Mr. J. W. Gardner, recently connected with the Sterling Boiler Company, and for a long time Western manager for Manning, Maxwell & Moore, has accepted a position with the sales department of the Sargent Company, Chicago, Ill.

Mr. Chas. F. Winn has been appointed master mechanic of the New Mexico Railway & Coal Company, with headquarters at El Paso, Texas. Mr. Winn was for many years general foreman of the Denver & Rio Grande shops, at Durango, Colo.

Mr. Thos. H. Symington has been appointed superintendent of motive power of the Atlantic Coast line, with office at Wilmington, N. C., vice Mr. R. E. Smith, promoted. He was formerly assistant superintendent of the Richmond Locomotive Works.

Mr. G. E. Hustis has been appointed general superintendent of the West Shore road, succeeding Mr. Chas. W. Bradley, resigned. Mr. Hustis has been private secretary to General Manager J. D. Layng for several years, and before going with the West Shore was with the New York Central for a long time.

Mr. M. E. Wells has received indefinite leave of absence from the Burlington & Missouri River to accept the place of First Lieutenant, Troop A, Third United States Volunteer Cavalry. Lieutenant Wells has been general foreman for the railroad company named, at Deadwood, S. D., for several years, and has written considerably for LOCOMOTIVE ENGINEERING.

Professor H. Wade Hibbard, who has been for a few years in the engineering department of the University of Minnesota, has gone to Cornell, where he will have charge of a school of Railroad Mechanical Engineering. Professor Hibbard was for several years chief draftsman of the Lehigh Valley Railroad, and is well equipped for the new duties he has undertaken.

Mr. F. O. Miller, traveling engineer of the Cincinnati, Hamilton & Dayton, at Ashland, Ky., has resigned to accept the position of traveling engineer of the Baldwin Locomotive Works. A host of his friends called on him on the evening of June 11th to wish him success in his new position, and as a token of their esteem presented him with a handsome gold chain and charm.

Our Senior Philosopher, Mr. Angus Sinclair, will leave New York, July 6th, on the steamer Britannic for Liverpool. He expects to visit Sweden and Russia, and intends going to see his old friend Mr. Walter F. Dixon, manager of the Sormovo Locomotive Works. For company he will have Mr. W. D. Sargent, of the Sargent Company, Chicago. He expects to be away about two months.

Mr. W. J. Murphy, superintendent of the Cincinnati, New Orleans & Texas Pacific is now Colonel. He was accorded the right of that title by Governor Bradley, of Kentucky, to whose military staff he has been appointed. This honor was given on account of the prompt manner in which the Queen & Crescent handled the numerous trains of troops which passed over its line to Chickamauga Park.

A circular issued by the motive-power department of the Philadelphia & Reading intimates that Mr. H. Delaney has been appointed master mechanic of the Philadelphia & New York division, with office at Ninth and Green streets, Philadelphia, Pa. This is not a new appointment, but is an extension of duties. Mr. Delaney has been for several years a division master mechanic, and this order greatly extends his territory. He has now over 300 locomotives under his charge.

Mr. Alex. S. Greig has been appointed general superintendent of the New Mexico Railway & Coal Company, with headquarters at El Paso, Texas. Mr. Greig was for years chief clerk of motive power of the Denver & Rio Grande, and when Mr. Sample became general superintendent of that road, Mr. Greig went with him as assistant. Mr. Greig was highly popular with the large body of railroad men he came in close contact with so long, and we wish him good fortune in his higher position.

We are pleased to learn that Mr. Edward L. Coster has been appointed assistant in mechanical engineering at Columbia University. Mr. Coster is particularly well informed about engineering relating to railroad rolling stock, and we are under the impression that considerable part of the work he will do in connection with Columbia University will be connected with the railroad plant. Mr. Coster is an associate member of the American Railway Master Mechanics' Association and of the American Society of Mechanical Engineers.

Mr. A. L. Moler, master mechanic of the St. Louis, Peoria & Northern Railway, has resigned to accept the position of president and general manager of the Thompson Smelting & Refining Company, of St. Louis, Mo. Mr. Moler was employed as an engineer for nine years on several of the best railroads of this country, and in 1895 was appointed division master mechanic of the Cincinnati, Hamilton & Dayton. Two years later he was appointed general master mechanic of the St. Louis, Peoria & Northern Railway, at Springfield, Ill. Mr. Moler has a very wide acquaintance, and has been one of the most popular officials on the road he is leaving.

Mr. William Voss, the well-known master car builder and mechanical engineer, has lately accepted the position of superintendent with the Jackson & Sharp Company, car builders, of Wilmington, Del. Mr. Voss, who is a graduate of a German technical school, rose on the Burlington, Cedar Rapids & Northern Railway from workman to be foreman of the car department, and then assistant master mechanic. He left there to take a position as assistant superintendent for Barney & Smith, of Dayton, O. The name of Mr. Voss is well known to nearly all railroad mechanical men through his book on car construction, which is the best work of the kind that has ever been published.

Mr. E. S. Marshall, who has been for several years general manager of the Western Railway Equipment Company, at St. Louis, Mo., has resigned to accept the position of general sales agent of the Missouri Car & Foundry Company. Mr. Marshall was for years master mechanic of the St. Louis, Arkansas & Texas Railway, and has an exceptionally fine acquaintance among railroad officials of the West and Southwest. He has taken a very keen interest in the Master Mechanics' Association, and was in the habit of getting the secretary to make requests that members be given permission to attend the convention. A good many members of the Master Mechanics' Association were able to attend the conventions through Mr. Marshall's efforts.

Dr. Gibbs, who was one of the few unfortunates killed when the marines took possession of Camp McCalla, was a brother of Mr. A. W. Gibbs, assistant mechanical engineer of the Pennsylvania Railroad, at Altoona.

EQUIPMENT NOTES.

Wells & French are building 500 freight cars for the Grand Trunk.

The Southern Indiana is having 100 freight cars built at Barney & Smith's.

Haskell & Barker are building 1,000 freight cars for the Illinois Central Railroad.

The Chicago Great Western Railway has two passenger cars building at Pullman's.

The Pennsylvania Railroad Company is building sixteen passenger cars at their shops.

The Ensign Car Company is building eighty freight cars for the Chihuahua & Pacific.

The Southern Indiana is having 100 freight cars built at the Terre Haute Car Works.

Barney & Smith are building two passenger cars for the Chicago Great Western Railway.

The Baldwin Locomotive Works are constructing four engines for the Lehigh Valley Railroad.

The Interoceanic Railway of Mexico is having two engines built at the Baldwin Locomotive Works.

The Michigan Peninsular Car Company are engaged on 1,000 freight cars for the New York Central.

The San Francisco & San Joaquin Valley Railway is having five passenger cars built at Pullman's.

The Richmond Locomotive Works have one engine under way for the Raleigh & Cape Fear Railway.

The Cooke Locomotive Works are building two engines for the St. Louis, Peoria & Northern Railway.

The Ohio Falls Car Company is building one passenger car for the New Orleans & Northwestern Railway.

The Mexican National Railroad Company is having 100 freight cars built by the St. Charles Car Company.

The Michigan Peninsular Car Company has ordered 500 freight cars under way for the Rock Island Road.

The Chesapeake Bay Construction Company is having one engine built at the Pittsburg Locomotive Works.

Six engines are under construction at the Richmond Locomotive Works for the St. Louis Southwestern Railway.

The Rogers Locomotive Works are building four six-wheel connected engines for the Illinois Central Railroad.

Ten six-wheel connected engines are being built for the Lehigh Valley Railroad at the Baldwin Locomotive Works.

The Pittsburg Locomotive Works are building seven consolidation engines for the Chicago & Eastern Illinois Railroad.

(Continued on page 361.)

How to Lay Out a Locomotive Boiler—Method of Laying Out the Dome and Dome Connection.

BY HENRY J. RAPS.

Figs. 1 and 2 represent one-half of the side and end elevations, respectively. The outer radius of the shell is 30¾ inches; inner radius of dome, 15 inches; its inner diameter, 30 inches; thickness, ½ inch.

Fig. 3 is a full-size illustration of the root of flange on side of dome as shown in Fig. 2.

As a rule, text books on this subject explain the laying out of the dome sheet on the assumption that the points of contact between the dome and shell are immediately below the circumference of the dome. This is correct in the case of one cylinder being simply cut to fit another, and not flanged, for where the dome is flanged, the points of contact are extended beyond its circumference, their position depending on the thickness of the dome sheet and the radius of the flange. This would make no material difference at the front or back, but it would make considerable difference at the sides, as shown in Fig. 3.

Assuming that the circumference is based on the diameter from center to center of the iron (which is correct), and that the points of contact are at *c* on the line *A B*, Fig. 3, and making the dome on this assumption, we would have it too short on the sides, as the points of contact are at *C*, Fig. 3, which is removed ¾ inch in a horizontal direction from the point *c* (should the radius of flange be larger, the point *C* would be removed still further from *c*).

In order to have the dome the proper length on the sides, we will enlarge the radius ¾ inch in laying out the elevation, making it 16 inches.

It is plain that this will not lengthen it at the front or back, but at all intermediate points.

Produce the lines *A B* and *C D*, Fig. 4, 16 inches apart and parallel with one another; at right angles with the line *A B* produce the line *A C*; make *A B* equal to the length of dome, or 24 inches, with *A* as center, radius *A C* produce the quadrant *C E*. With *F* as center, radius *F B*, or 30¾ inches, produce the arc *B D*. Divide the quadrant *C E* into six equal parts and from these points produce lines to intersect the arc *B D* and the line *A C*. For convenience in obtaining measurements with dividers, produce the line *G H* 2 inches from *B* and at right angles with *A B*.

To find the circumference, we will take the diameter from center to center of the iron. As the dome is 30 inches inside and ½ inch thick, we have $30 + \frac{1}{2} \times 3.1416 =$ 95.818 inches. In order not to have the casting too tight, we will add ⅛ inch, making the circumference 95.94, or 95 15-16 inches from center to center of holes.

To lay out the plate produce the line *A C*, Fig. 5. At right angles with *A C* produce the lines *A D* and *C D*, 95 15-16 inches apart. Produce the line *H H* to correspond with the line *G H*, Fig. 4. Divide this line into twenty-four equal parts, or four times as many as the quadrant *C E*, Fig. 4. From these points produce lines at right angles with *H H*, and upon these mark off distances to correspond with those in Fig. 4, as *G B*, *a n*, *b o*, *c p*, *d q*, *e r* and *H D*. A line drawn through the points so obtained gives us the flange line, to which add 2½ inches for flange.

Lay out the holes for seam on the lines *A D* and *C D* and the upper row of holes on the line *A C*, adding 1¼ inches from center of holes for lap. Lay out the holes for brace lugs and for inner flange. At the lower left-hand corner add the amount shown by the dotted line, amounting to

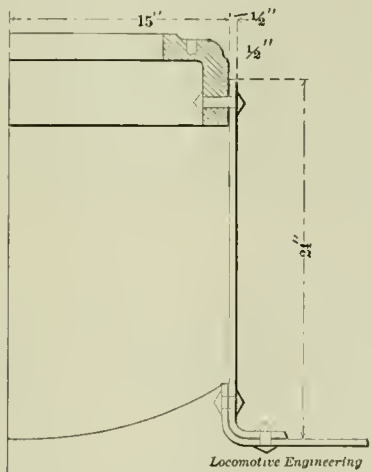


Fig. 1

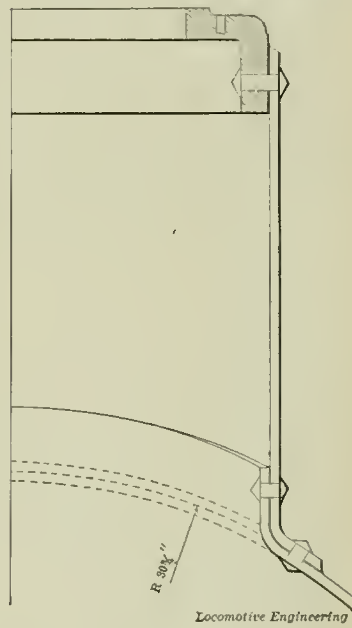


Fig. 2

LAYING OUT LOCOMOTIVE BOILER.

1¼ inches at the bottom, completing the laying out of the dome sheet.

To lay out the opening for dome produce the line *E E*, Fig. 6. Bisect it at *A*, and draw the line *D D* at right angles with *E E*. On the line *D D* make the distances *A n*, *n o*, *p q*, *q r* and *r D* equal the distances *B n*, *n o*, *p q*, *q r* and *r D*, Fig. 4, and draw lines through these points parallel with the line *E E*. Make the distances *A E*, *n s*, *o t*, *p u*, *q v* and *r w*, Fig. 6, equal the distances *A E*, *f s*, *g t*, *h u*, *i v* and *k w*, Fig. 4. A line drawn through these points will give us the flange line, to which add the flange, which in this case is 5 inches. Outside of the flange line 1¼ inches lay out the rivet holes, completing the laying out of this part of the dome connection.

Cedar Rapids, Ia.

Performance of Compound Locomotives.

Compound locomotives are not advancing readily in popular favor, but they are making progress into use. During a recent visit to the Baldwin Locomotive Works we found that about 60 per cent. of the locomotives on the floor were compounds. This is a greater proportion than any other of the locomotive works are building, but nearly all of them have some demand for compounds. In a few cases, locomotives that were built compound have been changed to simple, but this has happened very rarely, considering the radical change that has been made in the engine and the numerous difficulties to be overcome.

The Chesapeake & Ohio Railroad Company have had an experience with one compound which ought to be gratifying to those who are interested in this subject. A natural objection often heard to a strange type of engine is that time is necessary to demonstrate its value. The time has now elapsed sufficiently to demonstrate pretty fairly the weak and strong points of a compound locomotive. Six years ago the Chesapeake & Ohio purchased one compound ten-wheel engine, which was in all respects the same, except in the compound parts, as twenty-four other engines built at the same time. Two years afterwards Mr. H. J. Small, superintendent of motive power of the Southern Pacific, wrote to the Chesapeake & Ohio people asking for data upon compounds. Mr. W. S. Morris, superintendent of motive power, refering to his records of engine performance for 1893, took haphazard ten simple engines running on same division in the same service, and identical in all respects, save cylinders, to the compound, and made a comparison, which he forwarded to Mr. Small, and it was most favorable to the compound. Since that date Mr. Morris has continued the comparison, until he now has a five years' performance, a duration of service test which ought to be satisfactory to everybody.

Below is a table giving the relative performance of ten of the compound and ten of the simple engines. The comparisons are well worth studying:

	Average 10 Simple Engines.	Compound.	Gain in Percent
Engine miles...	175,141	210,874	20.4
Car miles......	6,073,980	7,521,006	23.8
Repairs	$5,339.83	$5,861.47	
Repairs per engine mile....	$3.05	$2.80	8.2
Tons of coal....	12,194	11,706	10.5
Miles run to ton coal......	14.36	18.01	25.4
Av. cars in train	36.7	37.	1.
Lbs. coal per engine mile....	139.25	111.02	20.2
Coal p. car mile.	4.02	3.11	22.5

Collecting Aid for the Sick Soldiers.

Mrs. Lang, the wife of Mr. V. B. Lang, master mechanic of the Cincinnati, New Orleans & Texas Pacific, at Chattanooga, Tenn., wrote to some friends at the Master Mechanics' Convention that the Daughters of the Revolution, of which she is one, were striving to obtain funds to supply the sick soldiers connected with the camp at Chickamauga with the small luxuries that are so much appreciated by the sick. Mr. Robert Quayle, superintendent of motive power of the Chicago & Northwestern, and Mr. J. H. McConnell, superintendent of motive power of the Union Pacific, undertook to make a collection, to aid the work in which Mrs. Lang is interested. They expected to be able to raise about $300, and proceeded to dun all and sundry attending the convention for a contribution. When they had done their best, they found that they had collected $810. As the collections went on they got to believe that the thousand-dollar mark could be reached, but their trains stalled at $810. Then Mr. Max Nathan, of the Nathan Manufacturing Company, came forward to fill the breach, and generously contributed $190, to make up an even $1,000.

On June 1st the C. H. & D. made its first actual schedule with their new motor car against the Traction Company. The schedule is slightly quicker than that made by the electric, the run being between Middletown and Hamilton, a distance of 14½ miles. They have adopted Traction Company's rates. The results so far are very much better than expected. They feel quite confident that, with the motor car making frequent stops and giving frequent service at the Traction Company's rates, and with their steam trains at the regular rates, and fast time, they have the situation pretty well in hand, and will make any attempts to compete with them for long distances by electric lines a very unprofitable investment.

The statement was made at the Master Mechanics' Convention by Mr. Robert Quayle, superintendent of motive power of the Chicago & Northwestern, that of the apprentices employed in their shops, 90 per cent. were sons of employés.

"The Ajax Blue Book" has been issued by the Ajax Manufacturing Company, of Cleveland, O., for the purpose of letting

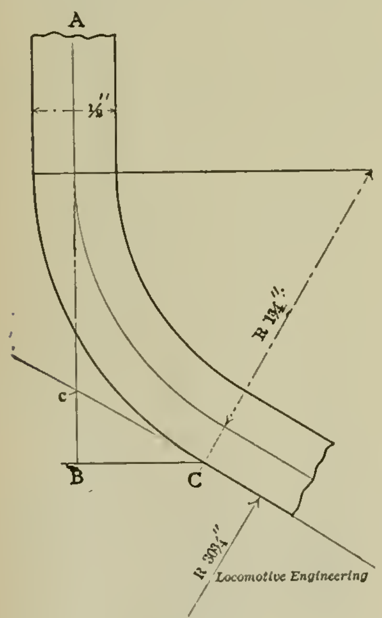


Fig. 3

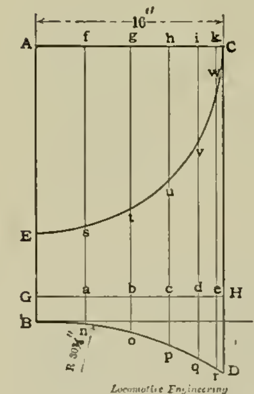


Fig. 4

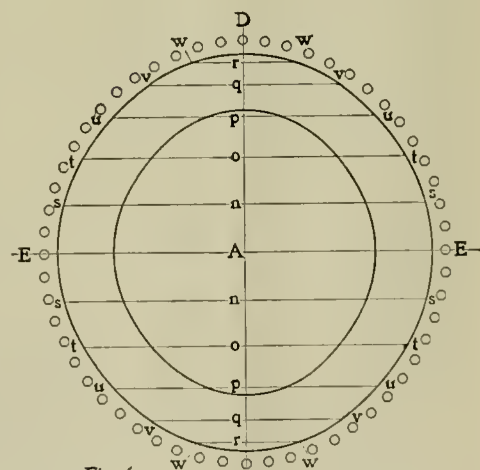


Fig. 6

LAYING OUT LOCOMOTIVE BOILER.

We have received from an official of the Big Four notes of the relative performance of four simple and four compound locomotives for six months. The cost per mile for the simple engines was 1.76 cents, and for the compounds 1.65 cents. The coal per car mile for the simple engine was 5.36 pounds, and for the compound 4.46 pounds. These figures indicate a saving of 6 per cent. in repairs and 16 per cent. for fuel, in favor of the compound. Several locomotive builders are now prepared to sell compounds on a guarantee to effect a certain saving of coal. The agreement is made to change them if not entirely satisfactory. No engine sold under this agreement has been changed.

There was considerable pleasantry in connection with the collection of this money. Someone would go to a supply man and say that Mr. McConnell or Mr. Quayle was looking for him. Seeing the vision of an order in front of him, he would drop everything and run straight to find the railroad man named, and on reaching him he would be greeted with the remark, "Five dollars, please." Then he would feel that a joke had been played upon him, and he would go around to play the joke on as many of his competitors as possible. The supply men contributed quite liberally, but nearly all the railroad men in attendance were very generous in their giving.

people know what the company's tools can do in the way of forming metal into required shapes. The book gives admirable illustrations of bolt headers, upsetting machines, forging machines, bulldozing and bending machines, and others of a similar character. It also gives specimens of work done on the various machines. The book will be very useful to blacksmiths, and every foreman blacksmith ought to send for one.

A German has protected his process of making "orthosulfamin-benzoic-acid alkyl esters" by letters patent. Seems to us the name is protection enough.

Two Drawing Room Kinks.

In a hasty visit to the drawing room of the Brooks Locomotive Works, two kinks were unearthed that might well be adopted elsewhere. One was a very complete system of letter files for current work. These contain specifications for each job and all correspondence relating to it. This puts all matters relating to any work, such as changes or other difficulties, which they can be referred to at will and always found. After the job is done, they are filed away for reference.

The other relates to printing titles on drawings. This is usually done by hand, but takes time, and consequently costs money. They use a rubber stamp (which is frequently done elsewhere of course), but they overcome the tendency to blot or blur in a very neat manner. The ink used takes a long time to dry, if left to itself, and drawings must be handled the same year they are made. So they simply bronze the lettering with a bronze powder, let it dry a little while, brush off the surplus, and there you are—the ink is dry and don't rub. The bronze titles and numbers look odd, but they come out all right on the blueprint, and they don't smut—that's the main point.

Baltimore & Ohio Passenger Ten-Wheelers.

Not a great while ago the General Superintendent of Motive Power of one of the largest railroad systems in the northern part of the country happened to visit Baltimore. Being of a courteous disposition, he called on Baltimore & Ohio motive power officials to pay his respects, and he was given an opportunity to see the new locomotives that have been purchased during the past two years. He devoted a great deal of his time to an inspection of the monster ten-wheel passenger engines that are used between Philadelphia and Washington on the sixty mile an hour Royal Blue trains. When he was ready to depart he turned to one of the company's officers and remarked:

"I have always been of the opinion that there was nothing on the Baltimore & Ohio road that was worth patterning after, but I am very frank to say that I have seen to-day the most advanced types of locomotives in the country. I know of no railroad in the country whose motive power is equal to yours."

Within a month after his visit to Baltimore this official ordered a number of locomotives, only stipulating that they should be after the plans of the Baltimore & Ohio engines.

The above information was received from the Baltimore & Ohio Railroad, and we are glad to be able, personally, to say a good word for the splendid ten-wheelers referred to. Through the courtesy of Mr. Middleton, General Superintendent of Motive Power, we enjoyed the privilege of riding on one of these engines in front of the Royal Blue Express, and we never sat on a locomotive that did its work more efficiently. At sixty-five miles an hour it rode like a palace car.

An Enthusiastic Flag Raising.

A large and beautiful flag was raised by the engineers and firemen and employés of the roundhouse at Waldo avenue, Jersey City, Pennsylvania Railroad Company, June 7, 1898.

The pole stands 203 feet above the ground, and is planted in the center of a large "flower plot" in front of the roundhouse. All trains passing at the time of the exercises were given a green signal between "A" tower and "S C" tower, so that the "boys" could not drop her in the corner, and to give the passengers an opportunity to get a glimpse of the "patriotism."

The exercises were opened by General Superintendent F. Walcott Jackson, and he addressed the crowd as "ladies and gentlemen" and "fellow employés," which brought a hearty applause. Among the prominent men present were Superintendent E. F. Brooks, S. M. P.; H. S. Hayward, M. M.; J. W. Sanford, Senator William Daly and T. J. Young. The flag was unfurled to the breeze by the genial roundhouse foreman and hearty good fellow W. S. Garabrant amid the whistling of engines and the band playing "The Star-Spangled Banner."

Appropriate speeches were made and heartily applauded.

The exercises ended with an elegant lunch, prepared by Major Trout, of the Pennsylvania Railroad dining-car department.

During all this time everything was moving along as regular as clockwork in the roundhouse, engines backing in and out. This is a very busy and wide-awake roundhouse, furnishing engines for the handling of about 250 trains in twenty-four hours.

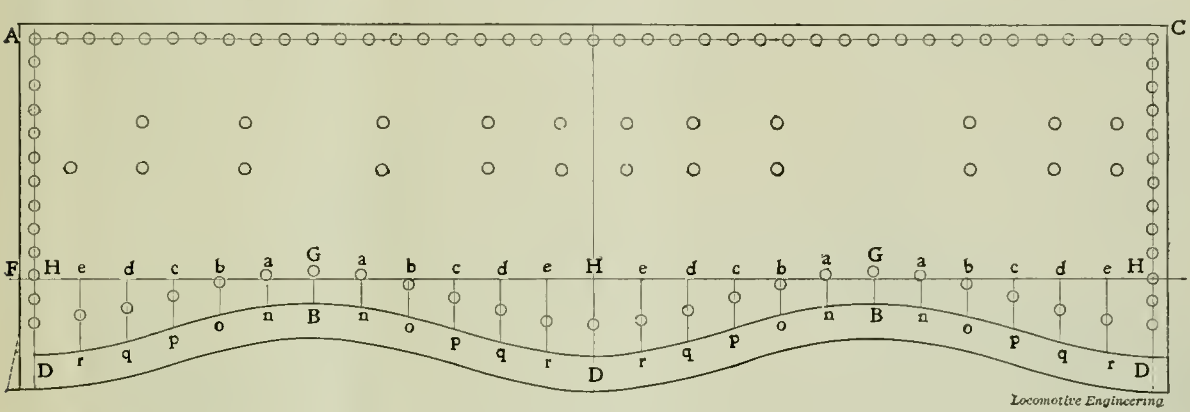
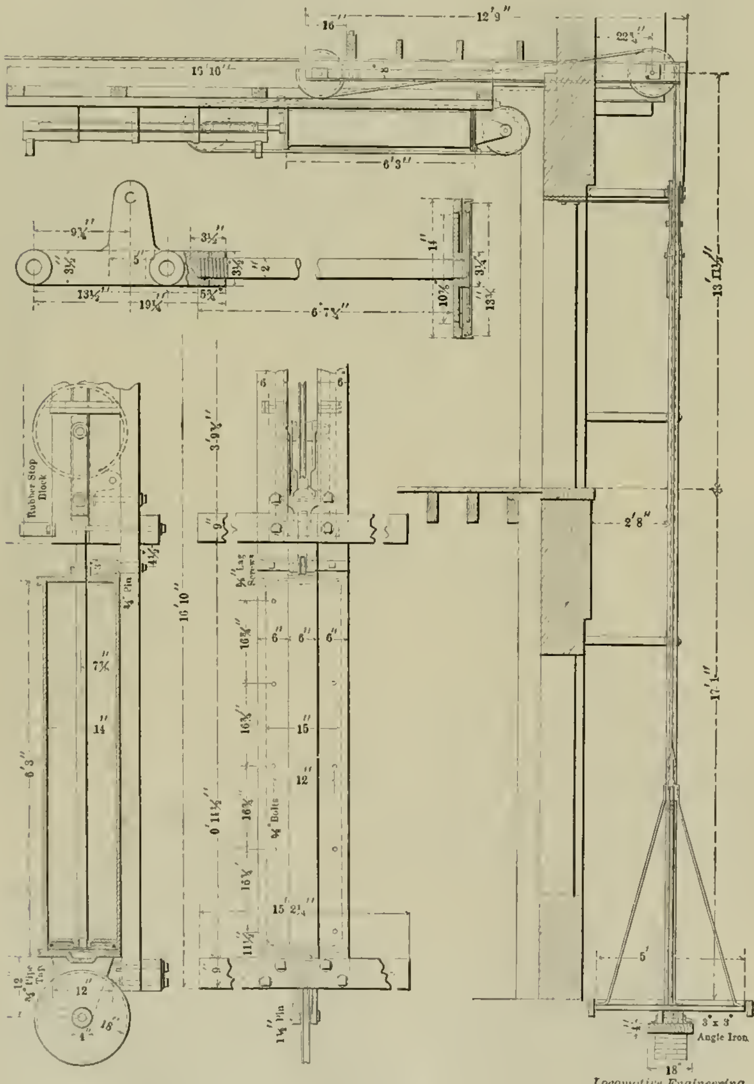


Fig. 5

LAYING OUT LOCOMOTIVE BOILER.

Threading Staybolts.

Staybolts that have the body reduced between the fits to a diameter less than that at the bottom of the thread, are expensive to make by the ordinary bolt-cutting machine, since the thread is cut the whole length, and is afterwards removed between the ends forming the fit, leaving only enough of the thread to pass through the sheets. This procedure is necessary, because it is obvious that a bolt having its body reduced before threading will not have a continuous helix on the two ends, or what would be one, if the middle portion of the thread were not cut away: in other words, the thread on the two ends will not "match." The effect is thus the same as stretching or compressing the bolt, so far as fitting the two sheets is concerned. Mr. Chase, the general foreman of the Manchester Locomotive Works, devised a way to cut bolts after reduction of the diameter at the center by forging, and still preserve the pitch of the thread constant for the two ends; th.t is, the same as if cut on a continuous piece. Briefly, it consisted of two half dies whose functions were to carry and guide the end of the bolt first cut, they being in line with the cutting dies and adjustable to any length of bolt. To set the guides, it was only necessary to place a hob or tap in them, and at the same time in the cutting dies, and clamp the guides in place. It is plain that a bolt so cut will have a thread similar to that cut on a continuous surface.



B. & O. PNEUMATIC ELEVATOR.

Mount Clare Shops.

The progress made in the rearrangement of tools and in placing the whole plant comprising the Baltimore & Ohio shops at Mount Clare, on a basis sure to give flattering returns, is changing the interior face of the old landmark so that the old-timer would easily fall into a retrospective mood, could he see how remorselessly old things are ripped out and replaced with new. There are signs on every hand that the dead past is buried, and that the future is to be untrammeled with points not essentially modern. In line with this spirit is the destruction of the old original Winans camel engines, the last of which are now being scrapped; and we confess to a feeling of regret that one of these cannot be saved as a reminder to those of succeeding years that Winans was far ahead of his time in locomotive design, for such an exhibit would carry conviction where the most gifted historian would fail.

As in the case of all old shops, the kind of tool equipment and arrangement of same require extensive and vigorous treatment to bring it up to the proposed new order of things, which had in view the inauguration of the piecework system. To move and relocate to the best advantage 197 machine tools, and that, too, without interference with the routine of repairs, was no small undertaking, but it was successfully accomplished by General Superintendent of Motive Power Middleton. All tools of a kind are massed, in order to turn out piecework with the greatest facility. Planers of like capacity are arranged so as to have their operating sides toward each other, and so with lathes having same swing. The advantages of such a scheme are shown to be an increased output at less cost, and a more satisfactory status among the men.

Another thing that contributes greatly to the piece system is the method of working to jigs and templates, than which there are few more elaborate collections in any railroad shop, and they are worked to and with, on all classes of work, old and new, in connection with blueprints on which is given the shop number of gages and jigs to be used on the detail shown by the print. This makes a drawing-office force a necessity, and the need is met by an equipment that is first class in talent and conveniences, comprising ten men in an office second to none in point of system and character of work.

Air is very extensively used on the well-known devices for shop work, but it has a novel application in the case of two pneumatic elevators, used for material going to and from the shops on the second floors. Our engraving shows one of these in elevations, and cylinder and piston in section. The platform is 5 feet square, and has a rise of 17 feet by means of a ⅝-inch steel cable which passes from the elevator frame over sheaves to the piston of a 14-inch cylinder, which is secured horizontally to the floor beams above. The ratio of movement between elevator and piston is about three to one. The machine is handled with an ordinary three-way cock, and is so smooth in its working as to recommend its use anywhere for ordinary lifts.

Among the many expenses borne by railroad companies the ice bill figures quite prominently. For instance, on the Baltimore & Ohio Railroad it is expected it will take over 50,000 tons of ice this year to meet the requirements of the service. The greater portion is used in connection with shipment of perishable goods; the balance in the passenger train service. A great deal of this ice is put up by the company in its own ice houses, but as the past winter has been so warm a very large proportion will have to be purchased.

Even historic Greece is being gradually covered with railroads, and the line between Piraeus and Larissa is being completed.

Air-Brake Department.

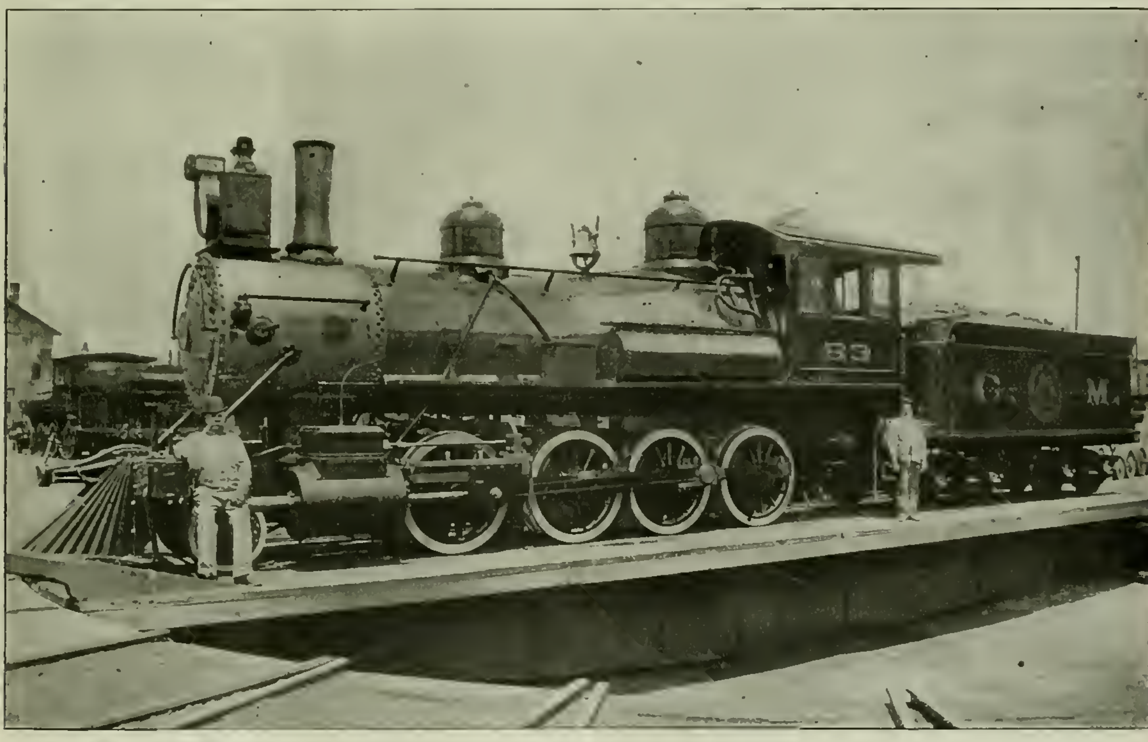
CONDUCTED BY F. M. NELLIS.

CORRESPONDENCE.

Location of Main Reservoirs.

Editors:

I herewith send you a photograph of an engine on the Colorado Midland Railway, showing the location of main air reservoir on the left running board, just ahead of cab. This position has been made the standard for this road by Mr. A. L. Humphrey, superintendent of motive power, and all engines are now equipped this way.



COLORADO MIDLAND CONSOLIDATED ENGINE, SHOWING LOCATION AND CAPACITY OF MAIN RESERVOIR.

These reservoirs were formerly on the back of the tank, and the advantage of the present position is appreciated, along with the fact of the saving of dollars and cents in air hose. These reservoirs do not look bad, are out of the way, and all probability of freezing is overcome.

You will notice the extra large size of reservoir, which is 24 inches in diameter by 91 inches long, having a capacity of over 41,000 cubic inches, or more than double the Westinghouse standard for freight engines. This is necessary for the safe operating of trains on long 3 and 4 per cent. grades, and the fact that an engine equipped with an 8-inch pump can safely handle a train of thirty cars on these grades demonstrates the advantage of large main reservoir capacity.

PAUL E. BROOKS,
Colorado Midland Ry.

Colorado City, Col.

Testing for Train Pipe Leaks.

Editors:

Perhaps it is somewhat out of place for a man who spends most of his time on the wooden end of the scoop to question the practices of an air-brake inspector, but I am prompted to do so, as Mr. Blackall makes some strange statements in his reply to Messrs. Hammond and Collom, in your May number.

Mr. Blackall, in reply to Mr. Hammond's statement that they had no valve on his road that would show a leak as stated, Mr. Blackall (February number) says "The gentleman is certainly speaking from theory rather than practice." Not necessarily so, for while Mr. Hammond makes a very strong assertion, Mr. Blackall's practical test, nevertheless, shows a very poor condition of valves. Should he test twenty-five of the engines I am used to firing, I fear his patience would rival that of Job if he waited for some of them to show a marked fall of the black hand.

I would like to ask if train line and small drum pressures are not equal at the close of reduction? If so, how can the black hand show the amount of train line leakage unless they keep equal?

Mr. Blackall says if a train line leak of 20 pounds and an equalizing reservoir leak of 10 pounds, "if given more time would continue to show further leak." Of what? Equalizing reservoir? Your train line may be exhausted for aught you know.

Mr. Blackall says a train line leak of that train line pressure will keep a little below the little drum. But how much? One, 2, or 20 pounds?

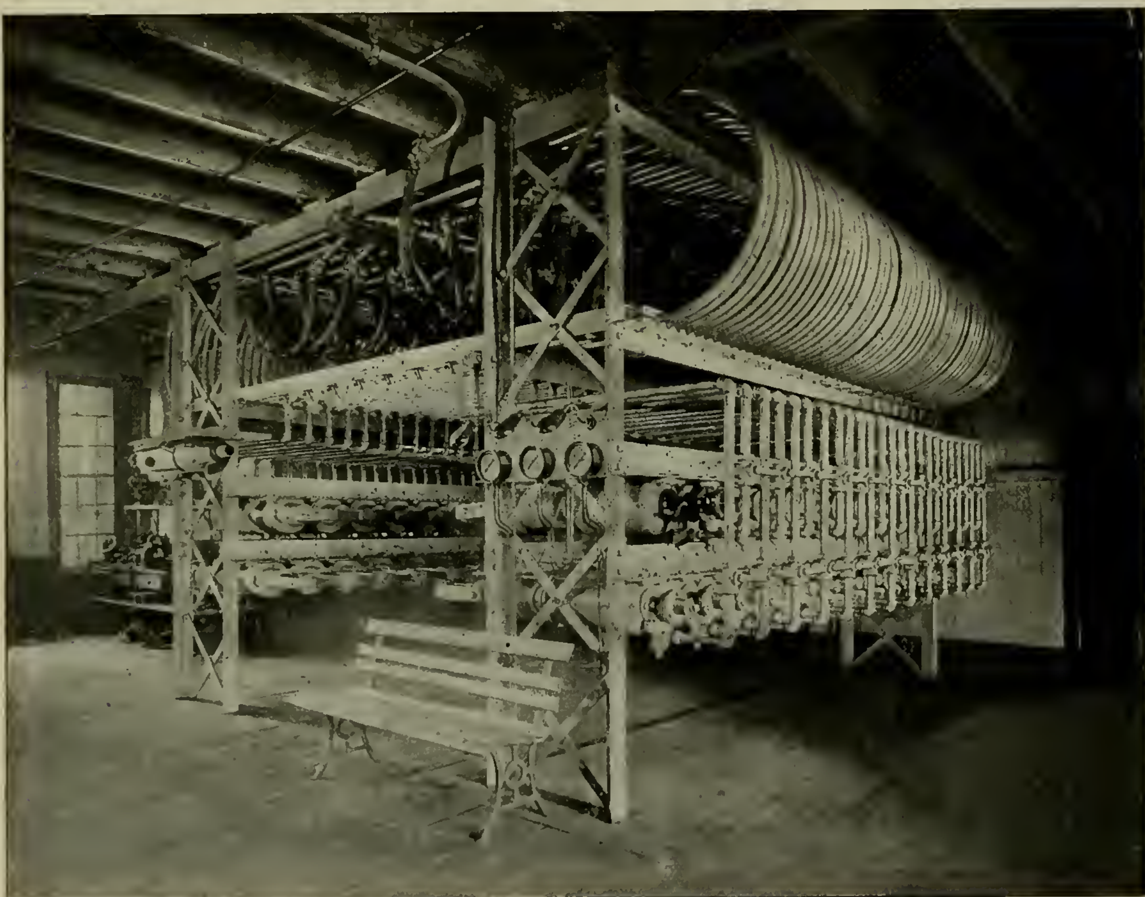
True, a fall of the black hand, after the brakes are applied, indicates a leak in train pipe or small drum. But if a train line leak it does not show the amount of that leak until train line pressure has fallen to zero, and small drum has followed: then, and not till then does the black hand indicate the amount of a train line leak, when the valve is on lap, taking train lines as they mostly are, and brake valves as they should be.

E. R. F. IRMAN.

Meadville, Pa.

[In reviewing and summing up the controversy brought on by Mr. Blackall's method of testing for train pipe leaks, the following may be said: Mr. Blackall found that a comparatively small leak in a hose coupling, pipe joint or connection, when fed by air from both the auxiliaries and train pipe, would cause such a small drop of the black hand as to indicate a leak of apparently little importance. However, when by a light application of brakes the triple valves were made to cut off communication between the train pipe and the auxiliaries, the same leak would be fed by the train line pressure alone, and in consequence the black hand would drop much more quickly and indicate a larger and more serious leak. Thus a leak which seemed trifling and was passed by, when sought for by the usual test, was found to be serious and demanded repair when subjected to the more rigorous test prescribed by Mr. Blackall. The test is a good one, and this part of it we do not believe has yet been challenged. The points on which there seems to be a disagreement are almost entirely, if not wholly those involving the part taken by the brake valve in the test. The function and operation of the equalizing piston are so well understood that discussion of those features is unnecessary. The condition of the equalizing piston packing ring has been the theme of nearly all the controversies. While the manufacturer endeavors to separate the pressures above and below the piston as perfectly as possible, he is nevertheless aware that a perfect separation with a metallic packing ring is impossible, for no matter how well fitted the ring may be in its cylinder, the sawed ends cannot be ground, and air will leak past. Leakage is greater on a poorly fitted or worn ring, and less on well fitted rings and when gum and dirt are present.

The part of the test original with Mr. Blackall is the slight application which brings the triple pistons in a position to cut off the auxiliaries. The leakage past the equalizing piston is the same in his test as in that of placing the brake valve handle on lap when brakes are off, and which has been so generally used ever since the brake valve was introduced.—Ed.]



THE NEW 50-CAR TESTING RACK RECENTLY INSTALLED BY THE AMERICAN BRAKE COMPANY IN THEIR WORKS AT ST. LOUIS, MO.

To Remove Dirt from Feed Valve.

Editors:

Occasionally we have loose dirt lodge on the face of the feed valve, which runs pressure in main drum and train line together, just when we haven't time to remove feed valve and clean it. However, this loose dirt can be removed very nicely, at first stop, by making reduction in the train line of 30 or 40 pounds, and then returning the valve to running position. This will cause a violent rush of air through the feed valve, which almost always carries this loose dirt with it.

The only objections to recommending this method to men is that they may rely too much on it for cleaning the feed valve, and seldom remove it for that purpose.

H. C. ETTINGER,
A. B. Insp., Wabash Ry.

St. Thomas, Ont.

Coupling Up a Broken Air Brake Train.

Editors:

I differ with Mr. O'Brien's plan of attempting to save air when coupling up a train by making a light reduction before the hose is coupled between the two sections.

In the first place, Mr. O'Brien is in error when he believes that a quick-action application cannot be had after a 5-pound service application has been made. It is true that more train pipe pressure is gotten into the brake cylinder in quick action when the auxiliary and train pipe are fully charged and the brake cylinder is empty.

It is also true that this amount of train pipe pressure going to the cylinder in quick action is less as the train pipe and auxiliary grows less and the brake cylinder pressure becomes higher, and a point will eventually be reached where it will be impossible to get any train pipe pressure into the cylinder; but this limiting point has not been reached when a 5-pound reduction has been made, as Mr. O'Brien believes.

I have made tests with proper length of train pipe, 8-inch piston travel and 70 pounds pressure, and find I can get train pipe pressure into the brake cylinder after I have made 13 pounds train pipe reduction in service. There is no doubt that trainmen are too careless in turning the angle cocks, and that they get quick action when it is not wanted, but a 5-pound service reduction before the cocks are turned will not prevent this.

The better way to save air and to get away most quickly after coupling up the twenty cars in Mr. O'Brien's example, would be to let back into the train pipe of the first ten cars, after the rear cock had been turned, just sufficient main reservoir air to release brakes and not charge up. The two sections will be very close, if not right together. Thus the auxiliaries on the head and rear sections would be about equal when the coupling is made. Then when the cocks are turned, the brakes on the head section will set with low pressure, whether it be service or emergency, and the main reservoir pressure that has been reserved will quickly let off all brakes. Air is thus saved in two ways, the brakes on head section set lightly, and the main reservoir pressure is reserved to release them and recharge all brakes in both sections at once. This is the quickest and easiest method of getting away after coupling up a break-in-two.

AMOS JUDD.

Boston, Mass.

An Air Signal Kink.

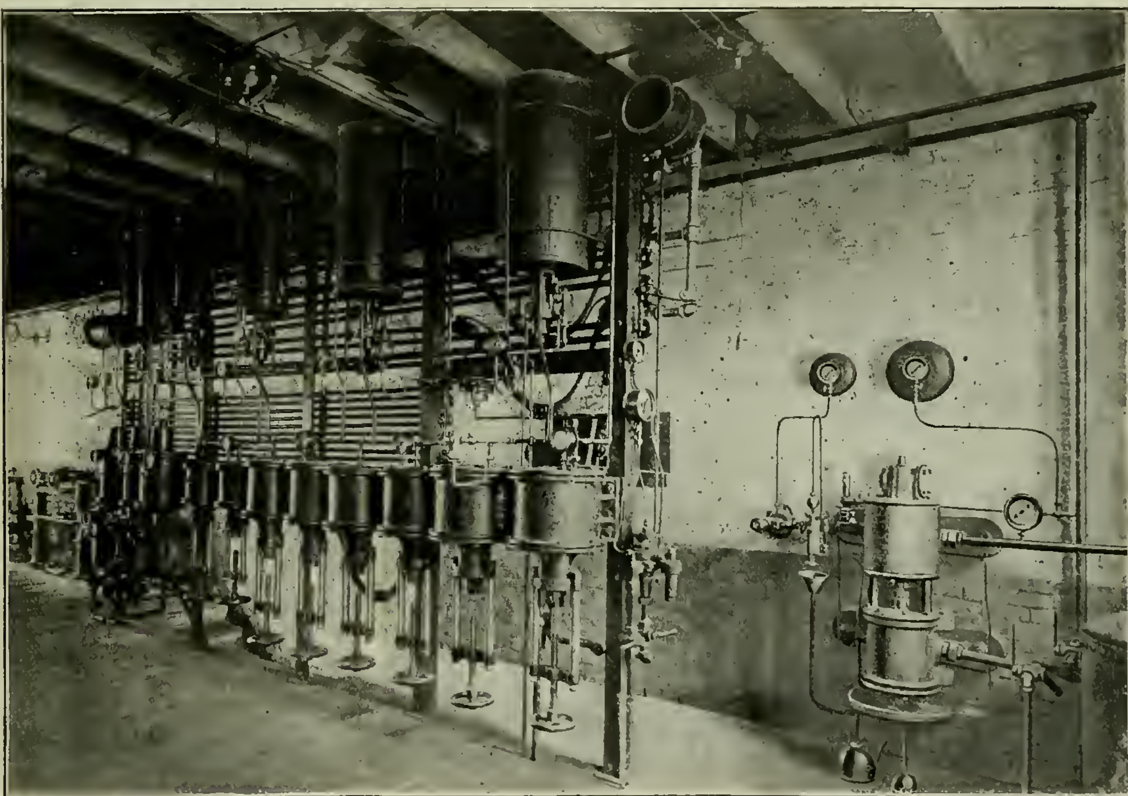
Editors:

Please publish the following in your air-brake department. An engine was coupled to two coaches equipped with the Westinghouse standard train signal, in perfect working order. Signal was also in perfect working order on engine and tender.

Engine and two cars were backed in on a siding, and a baggage car which had been cut off of another train was coupled on. When hose were coupled up and stop cocks turned, the whistle did not blow. Tests were immediately made, and whistle would not blow from any of the cars in the train. Why wouldn't the whistle blow?

Salem, N. J.

[The sender of this communication evidently forgot to sign his name, but if he will kindly write us, we will publish the name with the answer next month. The writer submits this as a puzzle to be solved by readers.—Ed.]



THE NEWLY INSTALLED DRIVER BRAKE-TESTING RACK AT THE AMERICAN BRAKE COMPANY'S WORKS AT ST. LOUIS, MO.

Testing Device for Air Brake Plants.

Editors:

The accompanying photograph shows the style of portable apparatus we are using for making repair yard tests of the air brake and air signal equipment on passenger, and the air brake on freight cars.

The cars are coupled not more than ten at a time. The machine is then wheeled to end of train, and hose 5 connected to air-brake train pipe, and hose 6 to air signal. The connection at opposite side of truck is made by means of a long length of hose coupled to a pipe between the tracks in repair yard, which comes from main reservoir in the shop, underground.

All angle cocks, except that at rear end of train, having been previously opened, all cut out cocks opened, all hand brakes released, all release valves closed and retaining valve handles turned down, the air is then cut in by opening cocks 3 and 4 in brake and signal train pipes respectively. While train is charging, a careful search is made for leaks, including triple exhausts and car discharge valves. All leaks found, having been stopped, and the train now being charged to 90 pounds pressure in brake system, and 40 in air signal; the cock 7 on reducing valve is closed, and the small gage on signal line carefully watched to see if all leaks have been stopped, and if all is satisfactory, cock 7 is opened, and five blasts of the air signal whistle must be got from each car in train.

Cock 3 is now closed in air brake train pipe; cock 1 closed, and 2 opened, which makes black hand of duplex gage connect direct to train pipe behind cut-out cock 3. It is then carefully watched to see if all leaks have been stopped. This having been done cock 2 is again closed, and cocks 1 and 3 opened, and by means of the engineer's valve a reduction of 15 pounds is made in train pipe pressure, and valve is lapped. Cocks 3 and 1 are then immediately closed, and cock 2 opened and engineer's valve moved into release position. The piston travel on each car is measured and marked with chalk on cylinder head; returning again to the first car so marked, a second measurement is now made, and if any piston by this time has lost over ½ inch travel, the packing will receive inspection later.

The testing apparatus is now returned to, and cock 1 opened gradually, causing air to feed via small gage pipe into train pipe, and a slow, steady rise produced in train pipe pressure, which can be seen on black hand of duplex gage, as it is now connected to train pipe. When a rise of pressure of 7 to 8 pounds has been made, cock 1 is closed and train inspected to see if all brakes have released. If any brake has not released, cock 1 is again opened and a faster rise is caused to train pipe pressure; this also failing to release this brake, the triple is marked to have piston inspected.

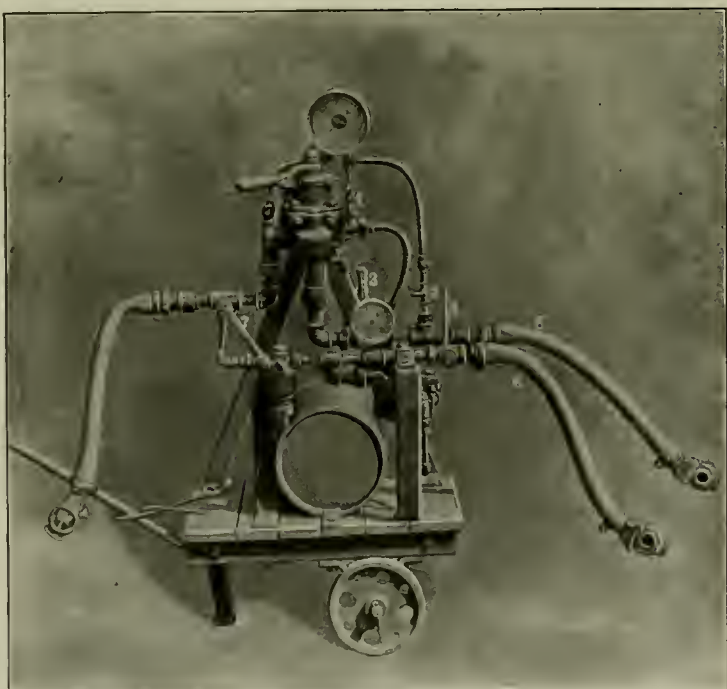
The train pipe now being fully recharged to 90 pounds pressure, cock 2 is closed, and cock 3 opened; the engineer's valve is again used, and all the air exhausted by placing handle in position 4 and leaving it there. If the blow from train pipe exhaust does not shortly cease, it is a sign of leaky checks, and any brake piston now losing travel, that held it before, is marked to have check examined.

The retaining valves are now turned up and handle of engineer's valve moved into release position; the retainer pipes are inspected for leaks, and brakes examined to see if any have come off; any so found, the retaining valve must be inspected, and if in good order the pipe must be more carefully examined.

The retaining valves are now examined, and if the air is still exhausting from small port, and the exhaust is weak, when handle is turned down, the retaining valve must be inspected and made tight.

The piston travel throughout the train is now adjusted to between 6 and 7 inches.

C. R. Ord,
A. B. Insp., Can. Pac. Ry.
Toronto, Ont.



TESTING DEVICE USED IN THE AIR-BRAKE YARDS OF THE CANADIAN PACIFIC RAILWAY.

An Air Pump Kink.

Editors:

A somewhat curious air pump kink occurred not long ago, which puzzled the writer, inasmuch that the cause of the difficulty was so totally obscured that it was by accident the discovery was made.

The pump had performed its duty all right, and the governor was in perfect order. Before leaving the terminal the train-line pressure was 70 pounds, and the pump worked to perfection; but after a few moments it was noticed that the air commenced to reduce to 50 and even 45 pounds. Approaching the first station it was noticed the pump again started, and it stopped at the required pressure; and thus it acted on throughout the trip. The engine steamed quite well, but the fireman thought it took a little more coal than usual.

Well, without further preliminary, or denying the possible causes of the trouble, I will say that I first made sure that there was no defect in the governor, throttle, or exhaust pipe. It was noticed a few drops of water found their way along the back of the saddle, and suspicion was directed inside of the extension smoke-arch somewhere. The door was opened, and it was found that one of the ears bolted to the tee had become broken; hence a leak of steam. When the engine throttle was open a jet of steam struck squarely the opening of the exhaust pipe of the pump, producing a back pressure. A new arch-pipe remedied all.

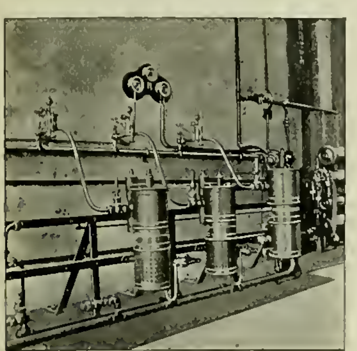
W. H. Durant,
B. & M. Ry.
Concord, N. H.

Leakage of Equalizing Piston Packing Rings.

Editors:

I notice from the May number of Locomotive Engineering that Mr. Blackall takes exception to my article in April number concerning proper testings for train pipe leaks. Mr. Blackall wishes to confine his argument wholly to train pipe leaks. I readily understand that he is quite correct in what we find in everyday practice. I am glad that this particular point has come to our observation.

I wish to ask Mr. Blackall if he uses this method on his line. If so, does the transportation department complain about



AIR PUMP TESTING PLANT, COTTON BELT RY., PINE BLUFF, ARK.

delays? To my notion this is a very lengthy test, and our transportation department would not allow us the time to make such tests on our twenty-five-car stock and meat trains. We are allowed but twenty minutes at junction points for change of engines, oiling and inspection. When more time than this is consumed, we have to charge it to some foreign cause. If we were to adopt Mr. Blackall's method, I am satisfied we would be outlawed in a short time.

Will you kindly say through the columns of Locomotive Engineering about what time is required for little drum pressure to pass equalizing piston and yet have a good working valve? I have made several experiments recently, the results of which are as follows: I took our Engine 11, made a 5-pound reduction, lapped the valve, opened the angle cock, and little drum pressure was lost in two minutes and forty seconds. In the same experiment with Engine 15, the little drum pressure was lost in fifty seconds. In the same experiment with Engine 20, the little drum pressure was lost in one minute and ten seconds. Engine 11 had the most perfect working valve of the three. I give you my experience for the benefit of Locomotive Engineering readers.

With Mr. Blackall's method of testing, little drum pressure would scarcely be controlled by the equalizing piston. For instance, make a 5-pound reduction on a twenty-five-car train, go to rear end and open angle valve partially, creating a leak that the pump could just about supply. Now start for engine and you will notice you will get nearly to engine before black hand commences to register the reduction.

Our enginemen here are required to look after the equipment on engines before leaving round house. When we couple a train and find pump unable to supply it, the inspectors immediately commence to look for these leaks. Our enginemen readily understand that the leak is back of him and we do not require any further test to ascertain where it is.

Mr. Collum's idea of watching the pump is a good one. I wish you would let us know your experience regarding the valve. What have you found to be the least amount of time required for little drum pressure to leak by equalizing piston and yet have a good working valve?

C. F. Hammond,
T., St. L. & K. C. Ry.

Frankfort, Ky.

[The time required in the general run of valves for the small reservoir to empty itself past the equalizing packing ring is about the same as indicated by our correspondent's figures. See our comment on "Testing for train line leaks," in this department. We have known a badly worn packing ring to empty the reservoir in thirty seconds, and yet the valve did fairly good work.—Ed.]

Lock Nuts for Air Pump Pistons.

Editors:

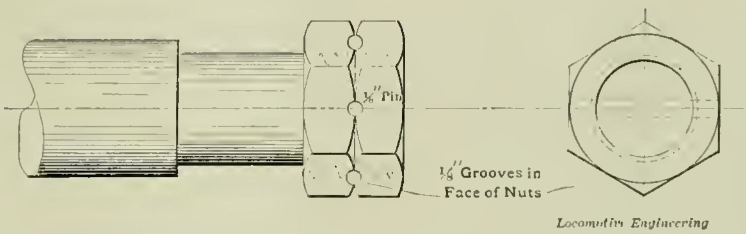
I enclose herewith blue prints of nut lock of air pump piston head nuts and jig for locating and drilling the pin hole through the rod. As you are aware, the numerous cases of air pump stoppage and consequent failures on the road, caused by the nuts on air end of air pump pistons becoming loose and working off, have resulted in the employment of several devices, each of more or less merit, to prevent such occurrences. The blue print herewith illustrates a novel and simple nut lock for the purpose which we have adopted, and is perfect in effectiveness. The arrangement may be briefly described as follows:

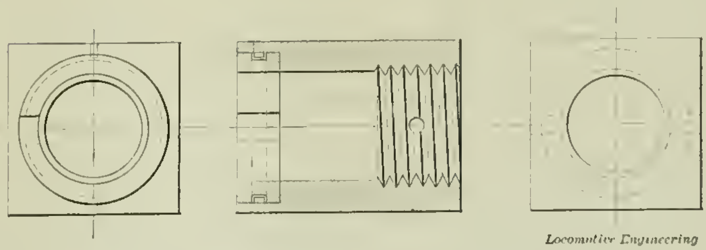
Both of the nuts have milled in their adjacent faces grooves 1-16 inch deep and ⅛ inch across from each hexagon side. A ⅛-inch hole is drilled through the piston rod, directly in line with the junction of the two nuts. It will be seen that when the inner nut is screwed tightly against the piston head, and the jamb nut set up, the grooves in their inner faces may be made to coincide with each other and one coincident pair with the pin hole in the rod, so as to allow the insertion of a steel pin, which, it is evident, will prevent either nut turning. The grooves being cut across from all sides of the nuts, it requires but slight movement to turn the holes in line. The nuts are screwed on a mandrel and grooved with a milling machine cutter, as the grooves require to be perfectly central with the thread.

The jig illustrated is used when drilling the pin hole in the piston rod. It is made square for convenience and is provided with an internal thread at one end, in order to screw it on the rod. Inserted in the other end is a loose ring, having a slot cut through at one side to admit the key which holds the head in position on rod. Two small dowel pins in the body of the jig extend into a groove in the ring and prevent it falling out, and at the same time permit the jig to be screwed on the rod when the slot in the ring has slipped over the key. Of course, the heads are removed when drilling the pin holes.

Jas. McNaughton,
S. M. P., Wis. Cent. Ry.

Waukesha, Wis.





DEVICE FOR LOCKING NUTS ON AIR PUMP PISTONS.

"Proceedings of Fifth Annual Convention of Association of Railroad Air-Brake Men" are now ready. Price, 50 cents, paper bound; 75 cents, leather bound

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(63) F. H., Wichita, Kan., asks:

What is the best kind of lubricant for brake-valve seats and triple valves? A.—Any oil which has sufficient body and will not gum may be used. A mixture of one part of beeswax and two parts tallow has been used on brake-valve seats, with good results.

(64) R. M. B., Atlanta, Ga., writes:

Cannot an 8-inch pump supply a train of forty or fifty cars, or is it impossible? A.—If a large main reservoir be used, an 8-inch pump will supply such trains as above mentioned. It is better, however, to use the 9½-inch pump in this case, as it has a greater capacity and will do the work easier. See article on "Colorado Midland Engine," elsewhere in this department.

(65) R. J. N., Cincinnati, O., asks:

Which will give the greatest braking power—a cam brake or the outside equalized brake? A.—Both styles of brakes may be designed to give any braking power within reasonable limits. The outside equalized brake, however, is much simpler in design, and can be applied on six or eight coupled wheels as well as on four wheel coupled. The cam brake can be applied, generally speaking, to but four-wheel coupled engines.

(66) J. C. W., Boston, Mass., writes:

In repairing a plain triple valve, I noticed a lump on the slide valve seat which caused the triple to blow out through the exhaust port. I faced the lump off, and the blow stopped. What makes this lump? A.—As the slide valve works in the service position so much, that part of the seat under the cavity of the valve does not come in contact with the valve face, and consequently does not wear. The neighboring surface does wear, however, and the lump is thus formed.

(67) J. P. D., Montgomery, Ala., writes:

If a train of thirty cars were charged up, would not the air pump have more air to compress to make all stops over a division, with every other car cut out, than if all were cut in? A.—Yes. To make a stop in a certain distance with thirty brakes, each brake would have to do a certain amount of work. Now, if every other car be cut out, the fifteen remaining brakes must do double work, each brake using twice the amount of air it used before, to stop the thirty cars in the same distance, and the air drawn from the train pipes of the fifteen cut-out cars is wasted.

(68) J. K. B., Louisville, Ky., writes:

1. Please explain the difference between emergency and quick action. A.—1. An emergency application is an application made to stop quickly for some unexpected cause, and may be made by any kind of brake—the plain triple, quick-action triple, hand brake or reverse lever. Quick action is that function of the quick-action triple which adds a part of the train line pressure to the brake cylinder in an emergency application, and at the same time helps to apply the succeeding brake. Quick action can only be had with the quick-action triple. 2. Can the plain triple give quick action? A.—2. No, for the reason above given.

(69) B. M. A., Providence, R. I., writes:

I have a brake valve that works very hard. It has been cleaned and oiled lately, but soon gets hard to turn the handle. The seat is iron and the rotary valve is brass. Is not this why the handle works so stiff? A.—The brass valve and iron seat will work well together if kept clean and well lubricated. Possibly the nuts are screwed down on the key too tightly. The rotary-key washer which rubs against the under side of the cap should be kept lubricated. Ofttimes a stiff-working handle can be traced to this washer when the trouble is thought to be in the rotory valve and seat.

(70) J. J. C., Brownwood, Texas, asks:

Should there be a difference in the time of release of brakes when making stops with passenger trains of different lengths, say one of five and one of twelve or fifteen cars? A.—The brake valve handle should be placed in running position a little earlier with a long passenger train than with a short one, so as to allow the triples on the rear cars to move to release position, get the brakes off, and prevent the shock. A trifle more time is required by the air to reach the last triple on a long train than on a short one. Once the triple piston goes to release position, the brake will release in a certain time, regardless of its position in the forward or rear part of the train.

(71) R. J. C., Richmond, Va., writes:

The air-brake instructions say that in pulling the whistle cord a second should elapse between pulls, or the signal will not be true. Why is this? A.—The pull of the cord makes an opening at the car discharge valve, and causes the signal pressure at that point to be reduced. The pressure elsewhere in the signal pipe is higher, and in coming to the region of reduced pressure, will draw away from that part of the system near the signal valve, thus lowering the pressure on top of the signal diaphragm which causes it to rise and send air to the whistle. If the proper interval is not allowed between pulls, the several reductions all merge into one, and make but one blast, or sometimes two. Hence the rule to get a true signal.

The constant and prominent agitation of the subject by the Master Car Builders, Master Mechanics, Air-Brake Men and Traveling Engineers, would impress one with the belief that the maintenance of air brakes has now reached a high degree of effectiveness and adequacy; but a close inspection of the facts, however, will prove that these orphans of the service are not yet rolling in the lap of luxury and indulgence that one might be led to believe.

H. W. Decker, air-brake inspector of the Southern Pacific Railway, died suddenly of appendicitis at his home in Sacramento, Cal., on May 29th. Mr. Decker was one of the foremost and ablest air-brake men in the country, having had fifteen years' experience in repairing, handling and superintending the maintenance of air brakes on the Southern Pacific road, and was a charter member of the Air-Brake Association. He was held in high esteem by his superior officers, and was popular with the men under him.

Several new brake shoes have made their appearance in service since the Master Car Builders made their last tests, three years ago, and it will be interesting to know just how nearly these new shoes will meet the claims made for them. It is probable that the committee will enlighten us on this subject some time during the coming year by making further tests.

During the month of May, 3,974 air-brake cars were forwarded from Nashville, Tenn., over the N. C. & St. L. Ry. Of this number 3,922 were in working order and fifty-two were inoperative. Eighteen of the inoperative brakes were on cars belonging to railways, and thirty-four were on private-line cars.

In discussing the maintenance of air brakes at the Saratoga meeting of the Master Car Builders, one member expressed a belief that air brakes are in a more serious state of neglect than is generally supposed, and that it is high time some systematic method of maintenance be adopted.

At the Saratoga meeting of the Master Car Builders last month, the committee on triple-valve tests was instructed to obtain and test all of the different kinds of triple valves now in service on the various railroads, and to report the results at the 1899 meeting.

The Master Car Builders' committee on brake-shoe tests reports that a sufficient number of new brake shoes were not presented during the past year to warrant making any tests.

The Continental Limited.

Mr. W. A. Garrett, superintendent of the Wabash Railroad at Decatur, Ill., sends us details of the recent fast run of the Continental Limited on that road on June 16th. The train had four cars, and was run by Engineer J. W. Brant and Fireman L. P. Light from Tilton to Decatur, and Engineer James Braddock and Fireman Paul Boltz from Decatur to Granite City; G. W. Jenkins was conductor. The engines were Nos. 601 and 603, respectively, both Baldwins.

The main points on the run are as follows, and are continuous runs:

	Miles.	Min.	On Run Aver
Tilton to Tolono	34.1	31.0	66.00
Tolono to Decatur	37.5	36.5	61.64
Decatur to Litchfield	61.0	50.5	64.78
Litchfield to Gr. City	44.0	39.0	67.88

176.6 miles, 169.5 minutes; average, 62.5 miles per hour; deducting stops, 176.6 miles in 163 minutes; average, 65 miles per hour.

Premiums for Fuel Saving.

Receiver Felton, of the Cincinnati, New Orleans and Texas Pacific, has obtained such satisfactory results from the payment of premiums to employés that he has concluded to introduce the premium system on the Columbus, Sandusky & Hocking road, of which property he is also receiver. Commencing the first of this month the engineers and firemen of both freight and passenger trains are to be contestants for monthly premiums, and later the payment of premiums will be extended to other employés. The premiums to be paid the engineers and firemen will be for economy in the use of fuel. Limits will be fixed each month for each class of engines and each class of service. The fuel limit in the passenger service will be based on the number of cars hauled, and in the freight service on the gross tonnage, including the cars and load. Half of the saving in fuel made by an engineer and fireman, under the limit, will be divided equally between the engineer and fireman, calculated at 80 cents a ton.—*Pittsburg Post.*

Patents.

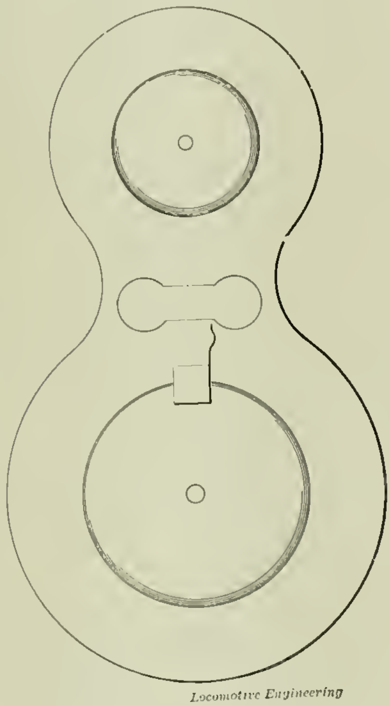
Some of the peculiarities of the patent laws were shown by the speakers on this subject at the A. S. M. E. convention at Niagara, one instance being cited where another patent on the use of the sand blast was granted because it was for a different purpose. The purpose in the second case was to attach it to the front of a locomotive to drive cows off the track—something on the order of the Gilderfluke "hobo extinguisher," which was shown on our famous locomotive.

Several instances were also cited where the patent had been granted to the man who first made the article in question for commercial use, rather than the one who had first invented it but had not used "due diligence" in putting into use.

This is a point to be considered by inventors. Get your inventions into practical shape as soon as possible, and also date all sketches and have them witnessed. This alone has been the deciding point in many patent lawsuits.

Doctoring a Cracked Hub.

The accompanying cut shows the method adopted by Master Mechanic Childs, of the Erie, at Jersey City, in taking care of a driving wheel hub that was cracked on the outside at the key-way; it represents the job as we saw and sketched it from an engine just in off the road. The outline immediately above the crack is that of an opening cut in the hub face about 1¼ inches deep, the ends 1¾ inches diameter and the center 1¼ inches wide, into which was fitted a piece of steel, which was driven in hot, and thus made to draw while cooling. The recess was slightly undercut, so as to retain the binder after being upset in place.



REPAIRING A CRACKED HUB.

Pneumatic Tools.

The Chicago Pneumatic Tool Company had at the convention a very thorough and interesting layout of tools of almost every kind now operated by compressed air, in the best and most advanced railroad shops, and rigged to show by manipulation what they were intended for. Drills, chipping and calking tools, flue expanders and rollers, and cutting-off tools for staybolts, jacks for car work and riveters, comprised some of the tools doing business under shop conditions. The riveter is a tool that commanded the attention of every mechanic, on account of the tight work it can do. Samples of its work, shown in joints planed down to the axial line of the rivets, show an absolutely perfect fit between rivets and holes. The reason for the excellence of the job lies in the fact that the setting of the rivet is due to impact and not pressure. The blow of the riveter is identical with that of a hammer which can strike a blow with lightning-like rapidity, in consequence of which the rivet is made to fill the hole before it has a chance to cool.

The power furnished for this exhibit was furnished by a 10 x 14 straight-line Rand compressor, which governed so closely as to make no fuss when the total load was thrown on. The Standard Pneumatic Tool Company also had some iron and wood boring tools going through their paces, driven by another Rand compressor. The show of air-driven tools was later enhanced by the Q. and C. exhibit of specialties in that line, tastefully shown and conveniently arranged for use by anyone who cared to test their merits. This show of air tools was a good index of the progress made in that line in the year past.

Fast Run with Projectiles.

An instance of the aid that can be rendered by railroads and railroad men in time of war is shown in the fast run on the Burlington Route of a train of ten freight cars loaded with ammunition for Admiral Dewey. The usual time of sixty hours between Chicago and Denver was cut to thirty-eight hours and thirty-two minutes, and the rest of the run was also made in fast time, considering grades and difficulties. This kind of work requires careful and competent men, and it should not be forgotten that they are as necessary as the fighters.

Contracts have been let for extending the Oban Railway through a very picturesque country in the Northwest of Scotland. There are some very difficult engineering operations involved in the work, several arms of the sea having to be crossed. The kind of tide found in that wild, rocky region may be inferred from the fact that at one place a rise and fall of 200 feet have to be provided for.

The Philadelphia & Reading Railroad is getting some new ten-wheelers. They are a fine type of engine, having a standard firebox on top of frames and between the wheels. Quite a change for this road.

Car Department.

CONDUCTED BY O. H. REYNOLDS.

Master Car Builders' Convention.

The Master Car Builders' Association convened for their thirty-second annual meeting on Wednesday, June 15th, at Saratoga, with an attendance that betokened more than old-time interest. After prayer President Knapp, of the village of Saratoga, welcomed the visitors and extended the freedom of the borough once more, with the assurance that it gave him unalloyed pleasure to see that the members knew a good thing, as was evinced by their repeated visits to his village. President Crone returned thanks to the speaker for the warmth of his welcome, and introduced Col. Cole, chairman of the New York Railroad Commission, who made an address based principally on the work of the Interstate Commerce Commission, with special reference to air-brakes and automatic couplers.

Mr. J. H. McConnell followed in a few well-chosen remarks, in which a comparison was made between the early equipment in rolling stock, both freight and passenger, and that of to-day, giving interesting particulars of size, weight and capacity. President Crone then came forward with his annual address, noting points of improvement and weakness in car design, and giving, without stint, his recommendations for a further betterment. The secretary reported 263 active members, 189 representative members and five associate members. As an evidence of a healthy condition of the exchequer, the treasurer showed a balance of $8,245.21. On account of this surplus, presumably, it was voted to put the annual dues for this body at $4 a year instead of $5, as heretofore.

The report of the Committee on Supervision of Standards and Recommended Practice of the Association was referred to letter ballot in all provisions except those referring to the standard top-hinged oil-box lid, standard journal boxes for 3¾ x 7 and 4¼ x 8 journals, M. C. B. automatic couplers, and recommended practice for loading poles, logs and bark on cars, and also specifications for M. C. B. coupler tests; these were all to go to committee for final adjudication.

In the report of Committee of Triple Valve Tests, Chairman Rhodes made a strong appeal for better work in equipment of air-brake cars with parts that were interchangeable and harmonious in all particulars. Safety in braking demanded this action of the association. The report was discussed at some length, and it was well shown to be the sense of the meeting that triple valves that do not meet all requirements should be known and given no place in car equipment.

The noon hour topical discussion was on the specification of lumber for freight cars, and opened by Mr. Leeds with an excellently prepared paper on the subject. There was little discussion, but what little was said was in favor of Oregon or Washington fir for sheathing, lining and roofing.

The subject of master car builders' journal boxes, stop wedges, brasses and box lids was not discussed at all, which was a matter for surprise, for the reason that the present shape or contour of the top of wedge is so notoriously away from correct lines as to be a constant source of annoyance, as well as expense for maintenance, by its shifty and inconstant characteristics in holding the journal load in a central position. It is matter for regret that action was not taken in the case, for it is as badly in need of good strong treatment as any detail in car work to-day.

Another subject of importance was passed over without discussion, namely, the paper read on a standard truck for 60,000, 80,000 and 100,000-pound capacity cars. It was not touched, but it is hoped that it left an impression that may be productive of results some other time.

The Committee on Brake Shoe Tests stated that the apparatus for prosecuting these tests had been transferred from Pittsburg to Purdue University, where facilities would be furnished to members of the association desiring to pursue investigations in that field.

The report of the Committee on Rust from Salt Water Drippings from Refrigerator Cars showed that track and bridge officials were making a keen inquiry into means for prevention of injury to tracks and bridges. Recommendations by the committee had not thus far met with favor from refrigerator car companies, as a rule. Bridges were found to be best protected by a covering impervious to the drippings rather than by any attempt at prevention of drip from the cars. While many roads find ample cause for complaint from the effect of dripping from refrigerator cars, the Milwaukee road, it was stated by a member, had found no cause for complaint from that source. It was voted to submit the report to letter ballot, with the understanding that the committee recommended a 1½-inch pipe to extend from each side of car to a point under the center sills, and lead the drippings to the center of the track.

The section of the interchange rules referring to knuckles excited a great deal of talk. It was finally voted to allow the rule to remain as printed. The matter of roofing, lining and sheathing material was referred to the Committee on Standards.

The subject of prices in interchange was taken up, and it was proposed to rearrange them so that they would include cars of greater capacity than 60,000 pounds. The figures given on prices for work done in the West tended to show a loss to the Western roads, owing to less cost for labor in the East for such work. Prices for 70,000, 80,000 and 100,000-pound axles were voted to be $12 per car for the first two, and $14 for the third, with instructions to the committee to make a price for second-hand and scrap axles also. The price for repairing a cut journal was a point for contention, when 25 cents per journal trued was proposed as a proper figure, to add to the old cost of removal and replacement of wheels. The proposed price was sustained by vote.

The price for work done west of the 105th meridian was brought up, when a Western representative proposed that an arbitrary figure of 15 per cent. be added to the present price for all work done, on the principle that the law of reciprocity should hold in railway matters as well as elsewhere, and that a spirit of fairness should prevail. The matter of differential, on being put to vote, was lost. A committee of five was appointed, consisting of a member each from the West, East and Middle District, and two from private car lines, to investigate the situation and report to the convention of 1899.

An amendment to place the price of drawbars for interchange at $8 was lost, and the figure of $7.50 proposed by the committee was allowed to stand. A motion to amend the constitution so as to hold the convention on the second Wednesday in June was carried.

Tests with a dynamometer to demonstrate the efficiency of side bearings made with metal trucks and bolsters showed that the center bearing truck was easier to pull, under all conditions. The report was ordered to be published in the proceedings of the association.

It was stated that 40 per cent. of the equipment of the rolling stock in the United States and Canada was fitted with air brake, and the necessity of better care in the matter of application of some of the fittings was well shown in a case cited, in which, out of 1,500 retaining valves, less than 150 were of any use whatever, either from leakage or faulty position and location.

When the hight of drawbars was discussed it was shown by one investigator that the only safe variation in hight on his road was 3 inches. More is admissible when the link and pin shall have entirely disappeared. It was moved and carried that the Committee on Recommended

Practice confer with the Interstate Commerce Commission on the subject of drawbar hight.

Steel framing of cars was left to wither and die. No action taken on the report of the committee; no discussion on same. Is it possible this illustrious body is afraid of tackling the subject?

Painting of cars by compressed air brought out complimentary allusions from the members, one of whom was turning out about 400 cars per week by the process, now well to the front. It was given as the sentiment of those who used compressed air that the spray was better than the brush in all cases, as it drove the paint into places inaccessible to the brush.

Election of officers wound up the proceedings for 1898, and the secretary was, on motion, directed to cast the ballot for the one list of nominations. Mr. E. T. Bronner declining the honor of succeeding to the presidency, which office was his in accordance with custom, he being the first vice-president, the ballot was cast by the secretary, with the following results, for officers of 1899:

President, Mr. C. A. Schroyer; first vice-president, Mr. J. T. Chamberlain; second vice-president, Mr. J. J. Hennessy; third vice-president, Mr. W. J. Robertson; treasurer, Mr. G. W. Demarest; secretary, Mr. J. W. Cloud.

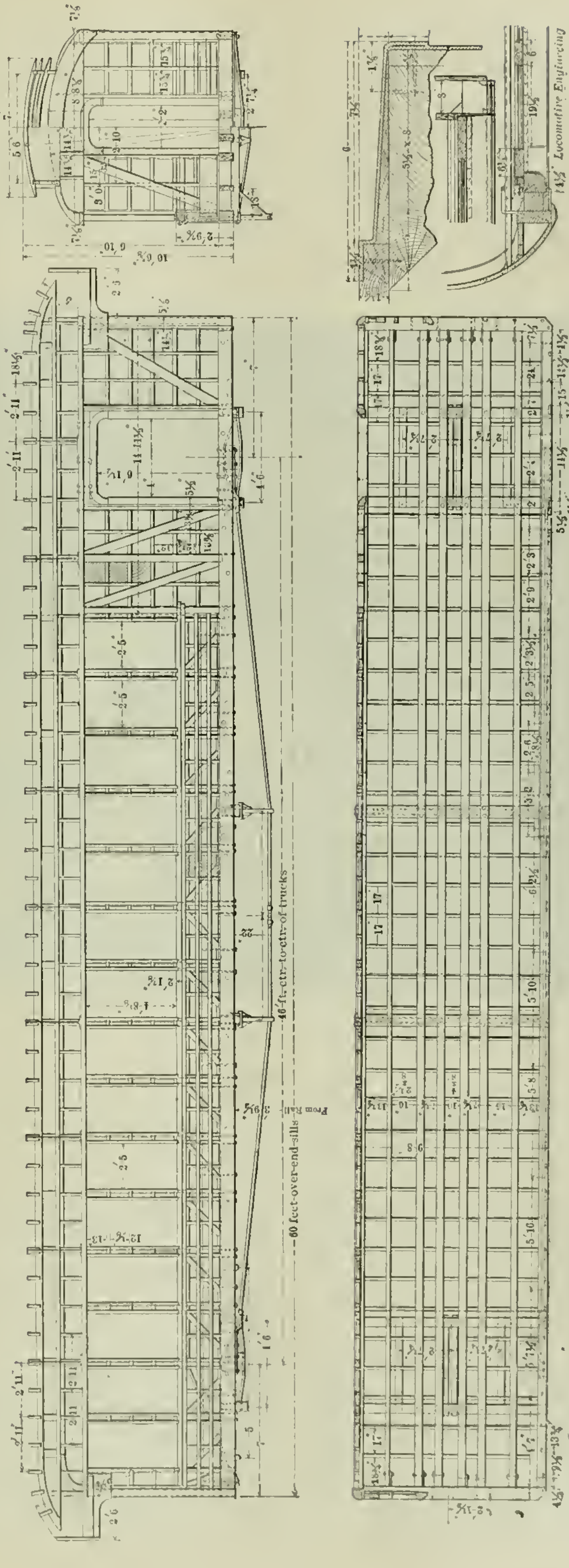
Combined Passenger and Baggage Car.

The engraving of framing of the combination car of the Erie Railroad, presented herewith, shows one of the new cars used in their through-train service. There is seating accommodation for sixty passengers, in addition to a baggage compartment 14 feet 6 inches long, making a total length over sills of 60 feet.

This car is carried on the six-wheeled truck illustrated in our April issue, and is therefore an exceptionally smooth riding vehicle. The framing is of a very light character, as will be seen by a reference to the dimensions of the members entering into its construction, and the fact that figures are given freely and accurately makes such reference a pleasurable task, since their function is to reveal and not conceal the sought-for information.

The car is one of a type made necessary by the heavy trains where a limited amount of baggage had to be transported, and it is well arranged for the purpose. The baggage door being placed centrally over the truck, gives an idea of symmetry, not present when placed at a haphazard point, as is usually done in such cars. The car is a representative one of the kind, and well demonstrates that wooden construction has reached a point where further extension, with reference to size, has nearly reached the limit, for cars in passenger service, if made as light as this.

The bracing of the car with so little room between the belt rail and sill, is well



COMBINATION PASSENGER AND BAGGAGE CAR.

arranged, and of a system that will hold up in good shape, as is shown by the diagonal braces and overhang truss. The result of carrying the belt rail down is to give a large window opening, and a consequent light and airy effect not seen in cars constructed on the cloister plan. Details of the door in the baggage end are shown in broken enlarged sections, in which are seen the plate and sill finish.

There are no marked changes from standard practice in these cars, other than

PULLMAN COMBINED SMOKER AND BAGGAGE CAR.

PULLMAN CAR BARBER SHOP.

to reduce the weight by close attention to the requirements of the several members, which are much lighter than rule of thumb practice would suggest as the proper thing. This is evident in all details of the framing from sills to carlins, and the conclusion is a natural one, that the dimensions chosen are the result of calculation. We are indebted to Superintendent of Motive Power Mitchell for the prints from which the illustration is made.

Westinghouse Friction Draft Gear.

One of the best methods of reaching the understanding of the average mind, with the aims and purposes of a mechanical device, is to show by an ocular demonstration what is sought to be accomplished, and to do this as nearly under working conditions as practicable. This is well exemplified in the case of the Westinghouse friction draft gear, which has been devised to mitigate the severity of blows on the draft gear of cars, by absorbing them through friction.

Every practical rolling-stock man knows that while attention has been given to increasing the security of draft rigging so that it is no longer pulled out by the roots, there has been little or no improvement in the springs, it being a fact that the same springs are applied to light and heavy cars alike. When it is known that the best of these springs have a resistance of less than 22,000 pounds before coming to a solid bearing, the necessity for a device that will absorb the shocks of service is apparent.

In the friction draft gear, the resistance is of such a yielding character, due to the friction of metal surfaces, that it is practically impossible for the blows received by the draw bar to be transmitted to the car frame. This is nicely shown by tests made under a falling weight, which shows the recoil of the ordinary draft spring, and the smooth absorption of the blow when the friction gear is placed under the drop. Such a demonstration is quite convincing that the claims made for the frictional features of the gear are founded on something more tangible than thin air. We note that all of the 100,000-pound steel cars recently built are fitted with this gear.

The Sheffield Motor Velocipede Car.

Through the courtesy of Mr. E. B. Linsley, secretary and treasurer of the Sheffield Car Company, Three Rivers, Mich., we enjoyed, while attending the convention at Saratoga, the pleasure of riding upon a motor velocipede car recently put upon the market by the company named. The motive power is a double gasoline engine placed beneath the seat, with every part accessible for examination or repair.

The aim of the company has been to produce a motor-driven velocipede car combining simplicity, lightness and efficiency, and they appear to have succeeded. The weight has been kept down, so that one man can put the car on the track and take it off as easily as he can perform these operations for the ordinary velocipede car. The car is under 250 pounds in weight, but it is capable of carrying two men up an ordinary grade at a speed of from fifteen to twenty miles an hour.

When the writer rode on it, there were two others, and it quickly attained a speed of twenty-five miles an hour, and rode very smoothly. We understand that a run of fifty miles can be made at a cost of 10 cents.

We understand that railroad companies are ordering this car so rapidly for the use of their roadmasters that the makers are flooded with orders.

Freight Car Exhibit.

The tendency of the times to show up the real thing instead of by model, was exemplified at the Saratoga convention to a greater extent than heretofore. The Schoen Pressed Steel Company had four of their hopper bottom steel cars on exhibition in the yards, conveniently close to the hotels. Three of these cars had trucks of the arch-bar type, with the members pressed to channel shape.

The Goodwin dump car was again on exhibition. This time it was covered with the signs of many a hard battle with ballast, that showed it was built for service, and had seen plenty of it. The Pratt gondola car of the New York, New Haven & Hartford Railroad was also in evidence in the group. This car is now improved with a slide bottom operated by a rack and pinion from the side of the car. The slide is of wrought iron plate, carried on a series of friction wheels that are located on the inside face of the sills at the pocket covered by the slide. The friction wheels carry the load on the slide and effectually prevent any binding in the gear and rack.

Arbitration Disputes.

In July, 1897, the Fort Worth & Denver City Railway Company rendered bill against the Southern Pacific Company (Pacific System) for journal brass applied to Central Pacific coach No. 2071, July 21, 1897. The bill was returned by the S. P. Co. with the claim that repairs to this class of cars are governed by the Appendix to the Master Car Builders' Rules, which are as follows:

"Rule 1.—Each railway company shall give to foreign cars, while on its line, the same care and attention that it gives to its own cars."

"Rule 3.—The receiving road is authorized to make such alterations and repairs as are necessary for the safe movement of cars over its line, and must immediately notify the delivering road of all such alterations and repairs, upon receipt of which notification the delivering road shall furnish proper authority to render bill for such alterations and repairs," and, according to its understanding of the above, it is clearly contemplated that the accepting road shall make an inspection of the car at the time of acceptance, and make such repairs as are necessary for the safe movement of the car over its line, and the delivering road shall furnish the proper authority to render bill for such repairs; but for any repairs which become necessary after that time, the road on whose line the car may be at the time such repairs become necessary is responsible for same, and not the owner of the car.

The bill was returned by the Ft. W. & D. C. Ry. Co. with the claim that it had complied with Rule 1, by applying a brass, the same as though it had been one of its own cars, and, furthermore, that it made the repairs necessary and notified the S. P. Co. as required by Rule 3, by attaching repair stub to the bill, which complies with the M. C. B. Rules for 1896, and that it sees no reason why its bill should not be paid.

The S. P. Co. again returned the bill, with the claim that there is no change in the Appendix to the M. C. B. Rules in 1896 from what they were before as regards notifying the delivering road of the repairs to passenger cars when received, and obtaining authority for making the repairs that are necessary for the safe movement of the car over the line of the receiving road; also, that there is nothing in Rule 3 which can be construed as authority to charge the owning road with such repairs as these in dispute, unless the owner is the delivering road, which is not so in this case. The S. P. Co. also requested that if the Ft. W. & D. C. Ry. could not see its way clear to cancel its bill that the same be submitted to the Arbitration Committee for a decision.

The Ft. W. & D. C. Ry. Co. returned the bill, quoting Rule 2, in reference to receiving and delivering cars in good general condition, etc., which would compel it to put in the brass to comply with the last clause of this rule. It also claims that Rule 3 covers the matter of notifying the car owner of any repairs being made, and, in its opinion, by attaching the repair card stub to its bill the owner became responsible; also referring to a circular issued by the S. P. Co. allowing repair card stubs to be attached to bills instead of having the cards sent through the mail, and, furthermore, that Rule 3 does not say that authority *may* be furnished, but that it *shall* be.

The S. P. Co. again returned the bill, and in reply to the statement of the Ft. W. & D. C. Ry. Co. that Rule 3 covers the matter of notifying the owner of car of any repairs being made, referred to Rule 3 as quoted, which shows that there is no reference to the owner, but refers to the delivering road, and that there is nothing in Rule 2 or Rule 3 that can, in any way, be construed as making the owner responsible, and that it is of the opinion that the Ft. W. & D. C. Ry. Co. is confounding the rules governing passenger car repairs with those governing freight car repairs, as there is no mention made of repair cards and repair card stubs, or to owners' defects in Rules 2 or 3 of the Appendix.

Failing to agree, all correspondence is referred to the Arbitration Committee for decision.

DECISION.

In the opinion of the committee Rule 3 of the Appendix is quite clear as for authority for such repairs as are necessary for the safe running of the car, and it is reasonable to suppose that cars shall not be held from service for authority to make minor repairs. Rule 4 of the Appendix is clear as to the nature of repairs for which authority is to be asked. There is no evidence to show that the car did not have proper care while in the possession of the Fort Worth & Denver City Railway. The bill of the Fort Worth & Denver City Railway is correct and should be paid.

Under date of May 6, 1897, the New York, Texas & Mexican Railway Company advised the Burton Stock Car Company that Burton stock car 6194 was wrecked on its line at Keeran's, on March 28, 1897, during a windstorm, and asked for shipping directions for return of trucks; also, that New England Car Company car 5333, operated by the B. S. C. Co., was damaged at the same time and place; that repairs would be made to the latter car, and bill rendered against the B. S. C. Co. Under date of May 13, 1897, N. Y., T. & M. Ry. Co. advised the B. S. C. Co. that the above mentioned cars were blown out of siding by windstorm, and the body of car 6194 completely demolished and wreck burned.

On May 17, 1897, the B. S. C. Co. requested shipment of trucks to Chicago, and stated that bill for value of body would be rendered from its Boston office.

Further correspondence with the N. Y., T. & M. Ry. Co. discloses the fact that it disclaims any responsibility whatever, and would not ship the trucks unless the B. S. C. Co. would guarantee the freight charges and authority to repair car 5333. The B. S. C. Co. then requested the N. Y., T. & M. Ry. Co. to repair N. E. car 5333, and render bill against the car owner, payment of same to be withheld until the matter could be submitted to the Arbitration Committee for decision, and invited the N. Y., T. & M. Ry. to join in bringing the matter before that committee for decision.

The N. Y., T. & M. Ry. Co. replied that the cars were damaged by a storm that did considerable damage to the property of that company at different points on its line, and that it was not possible for that company to have foreseen the cause or to have taken any further precautions to prevent the damage to the cars in question; that it gave as good protection to these cars as it did to its own and to its other property at various points along the line where damage was done. On this account it disclaims responsibility for damage to these cars.

The Burton S. C. Co. argues in reply that its claims are covered by M. C. B. Rule 3, sections 19 and 43, and refers to Arbitration Case 122 as a parallel case. It says that it would be a gross injustice to car owners and railroad companies were they held responsible for damage to their cars arising from negligence or accident under conditions not covered by existing rules of interchange while in the service of other companies, and that as these cars were blown out of siding and subsequently one of them was burned up, it believes the railroad company handling the cars is responsible for the damage.

Further correspondence failing to settle the matter, it is referred by the parties to the dispute to the Arbitration Committee for decision.

DECISION.

There is no evidence that the cause of the destruction of the cars in question was due to an act of Providence wholly. The fact that the cars ran out of the siding and were wrecked would indicate carelessness on the part of the railroad having the cars in its possession in not having the brakes set, and the fact that the cars were not destroyed where they stood, but ran some distance before being destroyed, would also indicate that the windstorm was not of such a nature as to have destroyed the cars had they been properly cared for by the railroad in whose possession they were.

In the opinion of the committee, the New York, Texas & Mexican Railway Company should either rebuild the cars and return them to the owners, or reimburse the owners for the value of same.

The New York, New Haven & Hartford road had their copper-sheathed passenger car on exhibition at Saratoga to show the effects of twenty months of wear and exposure to the elements. It would be impossible to distinguish the appearance of this car from one just out of the shop. The brilliant metallic sheen of a deep bronze tint which was noted on the first appearance of the car is still present. There is now no doubt of the success of the venture, and the sheathing question for passenger cars is practically solved, in so far as cheap first cost and immunity from exorbitant maintenance cost is concerned. The same road also had on exhibition a baggage car fitted up for the transportation of fancy and blooded stock. The interior is arranged with portable stalls placed lengthwise, making three stalls in the width of the car, all padded. The 50-foot car has a capacity of thirteen horses, leaving room for the groom. All castings required for the portable fittings are of malleable iron and arranged so as to be flush with the floor and walls. The interior of a baggage car can be transformed into a horse car in fifteen minutes by the arrangement used, which is one of the simplest thus far brought out for the purpose.

Why One Engine Ran to Time.

Old Jim Bliss was a driver on the North-Western, England, who was noted for giving vent to some original remarks occasionally.

A friend of the writer, on one occasion, ran down behind Jim from London to Bletchley. They had a first-rate run, and on arriving, our friend went up and remarked as much to the old man.

"Yes," chuckled Jim. "I knew the old hoss meant coming to-night, for she pricked her ears at starting."

WHAT YOU WANT TO KNOW.

Questions and Answers.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(54) Z. V. K., Charlotte, N. C., asks:

Will instantaneous opening of steam ports increase speed and save fuel over the up-to-date valve gear now in use? A.—Experiments here and abroad with gears of the four-valve type have given results that answer your question in the affirmative—as far at least as concerns the results given by the plain slide valve.

(55) H. B. W., Eastland, Cal., asks:

1. Has the Pennsylvania Railroad ever adopted a domeless locomotive, and was it successful? A.—1. Inquiry fails to show that the Pennsylvania road ever adopted a domeless locomotive. 2. Please give me the name of the fastest train (actual running time) that is operated in the world, on a run of 100 miles, and also the number of the engine. A.—2. It is impossible to furnish information of this character for want of reliable data.

(56) W. H. S., Salt Lake City, Utah, asks:

1. What is the proper way to block up a consolidation engine for a broken front tire or driving wheel; the second and third drivers have plain tires? A.—1. Raise the front wheels clear of the rail by blocking between the pedestal braces and driving boxes, after removing the front side rods. 2. Could engine be run ahead in this condition on a curvy road? A.—2. Not with safety; the plain tires would be quite likely to drop off the rails on a sharp curve.

(57) R. F., New Orleans, La., writes:

We have an engine here with the bottom water-glass cock below the crown sheet. Please say which is the proper place for the cock—above the crown, on a level with it, or below it. A.—The lower water-glass cock on locomotive boilers is usually located so that when water is in sight in the glass above the bottom nut, the water level in the boiler will be from 2 to 4 inches, and sometimes more, above the crown sheet. There is apparently no standard practice in this respect, other than to have water on the crown when it is disappearing in the glass.

(58) J. E. G., St. Paul, writes:

1. I am of the opinion that it is injurious to the ash pan, dampers and grates, to work a locomotive any distance with dampers closed, inasmuch as the exhaust on the fire has a tendency to warp the ash pan and dampers, together with the atmospheric pressure on the outside, and if there is much fire in the ash pan the grates are liable to get burnt or warped. What is your idea of this? A.—1. We agree with the views of our correspondent. 2. There is always a gas formed in the flues, whether the dampers are open or not. What is the nature of the gas formed in the flues when the engine is working and the dampers closed, and the latter and ash pan are as air-tight as it is possible to get them? Is the gas formed under the conditions stated dangerous and liable to cause an explosion. A.—2. The gas is carbon monoxide, and is of an explosive nature.

(59) M. C. D., Pueblo, Col., asks:

1. Of what benefit are relief valves to an engine? Do they prevent bursting of steam chest? A.—1. Comparatively few engines have a relief valve, in the correct sense of the word. A relief valve is a safety valve set at a little above boiler pressure. Nearly all engines have "vacuum" valves (called relief valves by many) which relieve, more or less, the vacuum in the steam chests when engine is running shut off. Some makers have a combined relief and vacuum valve. 2. What bad effect, if any, will result from ha'ing a simple six-wheel engine (145 pounds steam pressure) with one piston of 156.7 square inches and the other 162.296 square inches. A.—2. This is only a difference of about ¼ of an inch in diameter of cylinder, and will hardly be noticed. It is not uncommon to find cylinders on old engines differing ½ inch in diameter, due to reborings.

(60) J. S., Montgomery, Ala., writes:

1. Please explain the relative position of eccentrics to crank pin on a direct-motion engine, also the relative position of eccentrics to each other on an indirect engine. A.—1. Our article on "Irregularities of Cut-off," in the May number of this paper will give the information required, and our correspondent is also referred to "The Locomotive Link Motion," by F. A. Halsey, on sale in our book department, and the best work extant on the subject. 2. How can a slipped eccentric be set on a direct-motion engine? A.—2. There are several methods of bringing a slipped eccentric approximately to place, a simple one of which is, say, for a right go-ahead, to place right crank on the forward center with reverse lever in full back gear and make a mark on the valve stem at the gland. Then place the reverse lever in full forward gear, after which turn the slipped eccentric on the axle below and away from the crank, until the mark on the valve stem is again in its original place at the gland. For a slipped backing eccentric, reverse the process, first marking the valve stem for the correct position of the go-ahead eccentric. Another method is to place the crank as nearly as possible on the forward center, and if for a slipped go-ahead eccentric, place the reverse lever in full forward motion; then turn the eccentric below and away from the crank (if for a direct engine) until steam appears at the front cylinder cock. These methods are similar in results, as the port

opening is obtained in one case by the mark on the valve stem, provided the engine had lead, and in the other by steam showing at the cylinder cock.

Some Convention Exhibits.

There was much taste and ingenuity displayed in the arrangement of the exhibits to show them off to the best advantage, and while they were probably no greater in point of number than at past conventions, they were vastly more complete in detail. It is not easy to select any one as better than another, but among the specially interesting collections of devices known as essential to railway service, we noted the Reed pipe wrenches, which had a wide working range. One of these would take in pipe from ¼ to 1¼ inches diameter, which is an index of what other sizes would do. The other exhibits included:

McVicar and Sweet's oilers, in all sizes.

The Western Railway Equipment Company had the Houston track sander, and other specialties handled by them.

The American Steel Foundry Company's truck and body bolsters and couplers.

The Sargent Company's Diamond "S" brake shoe.

The Hancock Inspirator Company, with their composite injector, and other specialties.

M. M. Buck Manufacturing Company—Headlights, and automatic driver brake release.

Jenkins Brothers—Valves of all kinds.

International Correspondence School—Attendant with literature, covering the school and its aims.

Crosby Steam Gage and Valve Company—Gages and Chime whistles.

The Peerless Rubber Company, with everything in their line.

New York Belting and Packing Company, with samples of their output.

The Altman Car Coupler, the coupler without an uncoupling chain, and for which it is claimed no wear or change of contour will affect its efficiency.

The Shelby steel tube, compressed, flattened and expanded.

The Smillie coupler.

The Moran Flexible Steam Joint Company, and their specialties arranged so as to be a faithful representation of the battleship Kentucky, made up of their fittings exclusively, making the most novel and original conceit on the ground.

The Westinghouse Company and their engine running dynamos for exhibition purposes.

Schoen pressed-steel bolsters.

Peerless couplers.

Gould couplers.

The Q. & C. Company—Car seats and steps, and McKee brake slack adjuster.

The Gold Car Heating Company, with piping arranged complete for one car—the only car-heating exhibit on the ground.

The Rand Compressor Company, with air compressors at work for the exhibits.

The Cleveland City Forge and Iron Company, with a mammoth turn-buckle weighing 750 pounds, emblematical of their immense business in the turn-buckle industry, and also a fine sample of smooth forging. The better to show up this giant turn-buckle, there were with it two lilliputians about 3 inches long, just as perfect as forgings as the large one.

The exhibit of full-sized trucks at the Saratoga convention gives an impression of their gathering strength with each succeeding convention. The Buckeye truck showed the girder principle, and the Barber truck was there with the roller bearings for cars and tenders; the steel body and truck bolsters were represented by the Schoen, American and Simplex—all of which were gotten up in good shape. Another full-sized exhibit that drew attention was the Standard platform. There are no features about this platform that do not explain themselves even to those not up in car construction, and it therefore showed to good advantage.

The Smith journal bearing for cars seemed to attract the attention of car men at the convention, presumably for the reason that it had a wedge with a concave surface fitting a convex surface on the upper face of the bearing, or rather on the upper face of a piece of iron let into the top of the bearing. This principle of the ball and socket joint between bearing and wedge was in use several years ago on some rotary snow plows, where the bearings gave excellent results in carrying a load of 15,000 pounds per journal.

Among the patents for car truck details, recently issued, we note one to Mr. H. H. Sessions, and assigned to the Standard Coupler Company. The device is a center bearing for railway cars, consisting of a cradle suspended from, and swinging with hangers that have a transverse motion; the hangers being pivoted at the top and connected at that point to the truck transoms by suitable bearings; the top of the cradle performing the function of a truck center plate by receiving that of the car body. This will be recognized as being substantially the old swing motion, as formerly used on engine trucks, adapted for duty on car trucks.

The Pittsburgh & Lake Erie are putting down 100 miles of new steel rails on the main line. The heavy engines and cars that are used for hauling the ore from Pittsburgh are found to wear out the track much faster than the lighter rolling stock.

Places for Holding Conventions.

Every year there is a great deal of scheming among the people who attend the railway mechanical conventions to manufacture sentiment in favor of a particular place for holding the next meeting. This labor of love is generally carried on by the supply men or their female friends, and the sentiment is assiduously cultivated to make the conventions swing between Saratoga and Old Point Comfort. We think it is a pity that the members of the associations have their preference for the next place of meeting smothered under waves of sentiment worked up by people who ought to be ashamed to interfere. We have gone to considerable trouble to find out the sentiment of individual members about where they would prefer to meet next year, and a large majority wish to go West.

There has been keen disappointment that the Joint Committee failed to find accommodation at Colorado Springs. We should think that Denver could accommodate these conventions. A certain class who favor Saratoga and Old Point Comfort argue that no place is suitable for holding the conventions unless it has one hotel that can hold all the people attending. That argument appears to carry weight; yet in practice, the people always divide up among several hotels. There is no reason why they should not follow what was done so successfully in Boston, and divide up into half a dozen hotels.

Those most concerned are wailing, "Keep us away from sweltering Old Point Comfort for a few years longer."

Flags on the Northwestern Railway.

The officers of the Northwestern Railway have decided to show their patriotism and to inspire their passengers by decorating the company's buildings everywhere along the three divisions of the road. The first flags were raised on the Milwaukee Division.

The Stars and Stripes will also float over stations in Iowa, Wisconsin and Minnesota, and as there are about 7,000 miles of road, a large number of flags will be necessary.

A new railway contract between the Government of Newfoundland and the parties who are to build the road has some peculiar features. The number of trains to be run is to be determined by the government, and trains are required to run over the whole system at least three times per week, although these may be either passenger or mixed. The contractors furnished mail cars for $42,000 per year, and the cars are for the exclusive use of the government mail. The minimum speed of all through trains is fixed at 18 miles per hour, including stops. Freight rates are not to exceed 3 cents per ton per mile for distances between 50 and 100 miles. Passengers are only allowed 80 pounds of baggage. The contractor receives 5,000 acres of land for each mile of railway operated, and this includes all mines and ores found therein—this in addition to a previous grant of 2,500 acres per mile.

Siberian Railway.

Some idea of the immense amount of work involved in the construction of the Siberian Railway can be had by noting that on the four sections of the central line over 2,000 acres of forest have been cut down and the trunks uprooted; that nearly 30,000,000 cubic yards of earthwork have been laid, and over 156,000 cubic yards of masonry have been completed. Bridges are completed for 400 miles of this section in addition to 241 bridges on the section beyond; 678 miles of track have been laid, 565 of which have been ballasted. There have been over 1,000 line and station buildings erected on this section. Altogether about 1,700 miles of track have been laid. While this is partially to increase the commerce of the country, it is largely to obtain a rapid and safe way of mobilizing troops on the Chinese frontier.

The combined cylinder and half-saddle for lomotives has been a popular design for several years, it being supposed to have some advantages over the separate saddle, among which may be mentioned the single joint between the two halves, and also a lesser number of steam joints. We note the return of a prominent railroad to the separate saddle on some new heavy power—a return to the practice of years ago. There is something to be said for this style of cylinder fastening as well as for the other, first mentioned. If a cylinder is required to be removed for any cause, either a smash, or to replace the old with larger or smaller cylinders, it can be done at less expense than with the more modern half-saddle type. It is one of those questions with two sides to it.

Mixed on Time.

Dunkirk, N. Y., is forty miles west of Buffalo, and is supposed to use Central time, so that after leaving Buffalo you say to yourself as your watch points to 12 noon, "It isn't time to be hungry for an hour yet out here." In Dunkirk, however, you are apt to get mixed. You go to the shops and you find men get hungry same as you did, time or no time, and the shop stops at 12 o'clock by your time, too. Then you ask what time the 1 o'clock train goes east (is it a "bull" or not?), and they tell you, "One o'clock by railroad time, but it's 2 o'clock by right time." Of course the new system is best for all concerned, but this shows how long people cling to old ideas in some things.

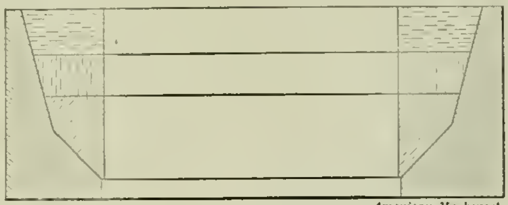
Large Engine Frames.

The increase in sizes of locomotives, and consequently of their parts, was strikingly shown at the Brooks Locomotive Works in their frame department. A comparatively new Bement frame slotter was noticed, with three frames being worked into shape. Inquiry showed that the machine had a stroke of 18 inches and was designed to take two pairs of frames at one setting, and on ordinary work would handle them nicely.

The recent large engines being built, however, had 5-inch frames, and consequently only three could be handled at once. The same thing is going on in many departments, and the men are wondering where it will stop.

The Multi Angular Packing.

The United States Metallic Packing Company, of Philadelphia, are making a new form of packing ring and vibrating cup to contain the same, as shown by the annexed cut. As will be seen from the illustration, this packing is made with two angles in the vibrating cup. By this combination a bearing metal much cheaper than the regular form of Babbitt metal may be used for the rings, and giving a large increase in mileage over the ordinary form, especially under high pressure of steam.



American Machinist

MULTI ANGULAR PACKING.

A Questionable Compliment.

A popular master mechanic was leaving his position, and the employés determined to give him a testimonial of their regard. The engineers took the lead in the movement, and they decided to make him the present of a handsome diamond pin. The matter was kept very quiet, and the first notice the superintendent of motive power received of it was in the way of a request that he attend a meeting to perform the graceful act of presenting the testimonial.

Now, this superintendent of motive power was strongly and conscientiously opposed to the practice of employés getting up presents for their officers, and on receiving the invitation he made vigorous protests against the present being given. He expressed the belief that the act would have a demoralizing effect upon the service. Then a deputation of engineers called upon him, and the spokesman argued that it was impractical to draw back, as the money was all subscribed and the present bought.

Then the S. M. P. gave in; but he concluded that a talk about the evils of giving presents to railroad officials would be in order. As he warmed up to his subject, he remarked, "You fellows never attempted to get up a testimonial to me, because you knew better."

In reply the spokesman said: "It is perfectly true, Mr. Mac, that we never tried to get up a diamond pin for you; but if you would quit the Gold Plate road we will give you the finest diamond we can find in Chicago."

What our contemporary, *The Locomotive Magazine*, calls a novelty, is a car journal box illustrated and described in its June issue. The box has earned attention by the fact that it has an oil or grease reservoir on top, besides the usual one at the bottom, in which are two fusible metallic plugs that fill holes in communication with the brass. The function of the fusible plugs is to melt when the brass gets hot, and allow the contents of the grease chamber to seek the journal. Of course the plugs will fuse dead on time and save the journal and brass, and then it is only necessary to fill the holes with more fusible material, to save the whole thing indefinitely. Fusible plugs have made a record on dry crown sheets, and journal boxes have done the same with oil in the bottom without the plug attachment.

"A Carnegie street car ran into a cow owned by James Bell, of Idlewood," says the *Pittsburg Post*. "A big hole was knocked in the end of the car, and the passengers and motorman badly scared and shaken up, but the cow walked leisurely away and began to eat grass." That was a pretty tough milk-making machine, and will provide lots of economical steak for some boarding house.

The Lukens Iron & Steel Company, Coatesville, Pa., are giving to their friends an engineering hand-book which contains a great deal of useful and original information, especially about steel plates.

The Rules of Interchange adopted by the Master Car Builders' Association have assumed voluminous proportions, and they do not decrease by the revisions given the document. It had a revision at Old Point Comfort last year which cleared up some points and left little room for doubt concerning their construction. The care with which the subject has been let alone in club work shows that there is not any desire on the part of the members to discuss the rules at this time, they being willing to regard it as closed to the clubs, but reserving the right to kick in private. An old time master car builder suggests that a prize be offered for a code of rules to cover every possible contingency in interchange of traffic, brevity and clearness to take the money. The proposition does not seem altogether a bad one.

The avidity with which the morbid tourist welds himself to everything that savors of the least excitement, was disgustingly apparent a few nights since on a steamer bound from Albany to New York. Along toward midnight the steamer collided with, and sunk a schooner. Our friend the tourist-who-never-misses-a-trick hastened to the deck in his night-shirt, while the crunching of timbers and the cries of the unfortunte crew were still coming from the inky depths; but he was no hog; he proposed to have his wife, who was already in hysterics, share his enjoyment, and rushed to his stateroom with the invitation to her to "come out and see these people drown."

"Forest Preservation" is the subject of the third annual report of the Chief Fire Warden of Minnesota. This volume, which has just reached our table, contains a great deal of valuable information about forests and how they can be preserved and made profitable to their owners. This is a subject on which Americans, as a rule, are very ignorant, and the report before us will do much to disabuse this ignorance wherever it reaches. The report was prepared by C. C. Andrews, Chief Fire Warden, whose address is St. Paul, Minn.

For the past eight months the Baltimore & Ohio Railroad has been keeping an accurate account of the tons carried per train mile on the entire system in order to ascertain to what extent the improvements had increased the train haul. The results have more than justified the expectation, as the average for the eight months ending February 28th is 323.13 tons per train mile. This is certainly a good showing, as the average in years gone by did not exceed 225. The average for the year will doubtless be much larger.

One would think that a car load of metal polish would do all the polishing in the country for a year, yet we are informed that George W. Hoffman, of Indianapolis, Ind., has, within the last three months, shipped two car loads of metal polish to foreign countries. The use of the Hoffman polish greatly reduces the amount of physical energy required to put a boiler-head in good order, as many a hard-worked fireman is ready to testify.

The Northern Railroad of Guatemala is to be sold or leased in order to secure its completion, as the government does not feel warranted in making the necessary expenditure. The construction is said to be difficult, but engineers estimate that it can be completed in two years, at a cost of $2,500,000. It is believed that this will be of considerable importance in increasing trade between that country and this.

A catalog has been issued by the J. G. Brill Company, Philadelphia, Pa., illustrating their standard sprinkling cars. These cars are used generally by street railroad companies and are a very great convenience. Those made by the Brill Company appear to be about the best of their kind and have good features that no other sprinkling car possesses.

Soda ash used in boilers for purification of feed water, leaves a never-failing telltale on all leaky joints or seams, in the shape of a snowy spot. If water gets to the outside of the boiler, there, too, is the soda ash, and in roundhouses a plan of the tank is clearly outlined on the floor. It is searching stuff to find a leak.

It was reported that one of the London and Northwestern Railway Company's engines, which bears the name "Gladstone," was attached to the train which brought Mr. Gladstone's remains from Chester to London. The engine had been previously sent to the carriage shops at Crewe to be painted jet black.

Persons interested in the economical handling of coal ought to send to C. W. Hunt Company, 45 Broadway, New York, for their catalog called "Hunt Automatic Railroad." The catalog is sure to give them information that will be of money value.

The *Locomotive Magazine* for June has a very attractive supplement, in colors, of a late express engine of the Caledonian Railway. It is a four-wheel coupled engine, and is splendidly reproduced.

EQUIPMENT NOTES.

(Continued from page 340.)

Seven eight-wheel engines for the Southern Pacific Railway are being built at the Schenectady Locomotive Works.

The New York & Ottawa Railroad is having built at the Baldwin Locomotive Works two six-wheel connected engines.

The Brooks Locomotive Works are building five consolidation engines for the Buffalo, Rochester & Pittsburg Railway.

The Western Equipment Company is having twenty-five freight cars built by the Illinois Car and Equipment Company.

Ten six-wheel connected engines for the Texas & Pacific Railway are under construction at the Rogers Locomotive Works.

One six-wheel connected engine is being built for the Loraine Steel Company at the Pittsburg Locomotive Works.

The Hutchinson & Southern Railroad is having two six-wheel connected engines built at the Manchester Locomotive Works.

One consolidation engine is being built for the Choctaw, Oklahoma & Gulf Railroad at the Baldwin Locomotive Works.

The Cleveland, Cincinnati, Chicago & St. Louis Railway is having two consolidation engines built at the Pittsburg Locomotive Works.

Four consolidation engines are under construction at the Pittsburg Locomotive Works for the Chicago, Burlington & Quincy Railroad.

The Fremont, Elkhorn & Missouri Valley Railroad have fifteen six-wheel connected engines building at the Schenectady Locomotive Works.

The Florence & Cripple Creek Railway is having fifty freight cars built by eighty freight cars for the Chihuahua & the Michigan Peninsular Company.

The Ohio Falls Car Company is building 150 freight cars for the Nashville, Chattanooga & St. Louis Railway and twenty for the Rio Grande & Eagle Pass.

The Richmond Locomotive Works have just received by cable an order from the Finland (Russian) State Railway for seventeen compound locomotives. This is a great tribute paid to American industry, the Richmond Locomotive & Machine Works being wholly without influence in Russia, and the order being given entirely upon the merits of their workmanship.

Thirty new consolidation freight locomotives have been ordered during the past week by the Baltimore & Ohio Railroad, and the order has been divided as follows: The Baldwin Locomotive Works, fifteen with 21 x 26-inch cylinders and five with 22 x 28-inch cylinders; the Pittsburg Locomotive Works, ten with 22 x 28-inch cylinders. The large engines are for use on the mountain divisions, while the others are of the same class that are being used between Cumberland and Baltimore.

Pumping Bicycle Tires by Power.

The advance of the bicycle into general use was recently shown very clearly in visiting several large shops. Not only is a room very often provided for their safekeeping, but in many places there is now a permanent connection to the air line for pumping tires.

All you have to do is to connect the tube to your tire, open the valve slowly and get any pressure you want, some places having a gage showing how much you were throttling and warning you not to use over 40 pounds of air. This is a great convenience, and is apparently used by everybody, from the president down to the office boy.

A bill has been introduced into Congress to prevent sleeping car companies from letting down the upper berth of a sleeping car when not in actual use. This is in line with the bill that we expect to see introduced soon forbidding hotel keepers and the people who run restaurants from charging Congressmen more than 25 cents for a full meal, and preventing those people from charging anything extra for dessert. The greatest blessing that could come to this country would be for the people to rise in their might and say that they would get along without meetings of Congress and of State Legislatures until further notice.

We recently noticed a wrecking outfit at Martinsburg, on the Baltimore & Ohio Railroad, that had the appliances used in wrecking put up in ship-shape, and in a get-at-able way for instant work. The emergency trucks were on a flat car and unhampered by other stuff, contrary to ordinary practice. On the top of these trucks were car replacers, lashed securely and easy to reach when wanted. The whole arrangement showed the work of a mind that had some ideas of wrecking tools and how to care for them, so as to get the greatest good from them when called upon for service.

The friends of federation were a party seen at the last convention of Locomotive Engineers, and they made a great struggle to have the Brotherhood of Locomotive Engineers federate with the other train orders and the telegraph operators, but without success. The enthusiastic friends of this movement say it is coming, and they are hopeful that when the next convention comes around that federation will be effected.

Richmond Locomotive Works Compound System.

A general view of the cylinders, intercepting valve chest and steam pipes on the Richmond compound engines is shown in Fig. 1, in which the course of the steam from the boiler to the cylinders, and thence to the exhaust when working compound, is indicated by arrows. Following these from the dry pipe they are seen to pass down the steam pipe to the high-pressure cylinder and to the cavity around reducing valve. From the high-pressure cylinder steam exhausts into the receiver and passes from there through the intercepting valve into the low-pressure steam chest and cylinder, and finally to the exhaust.

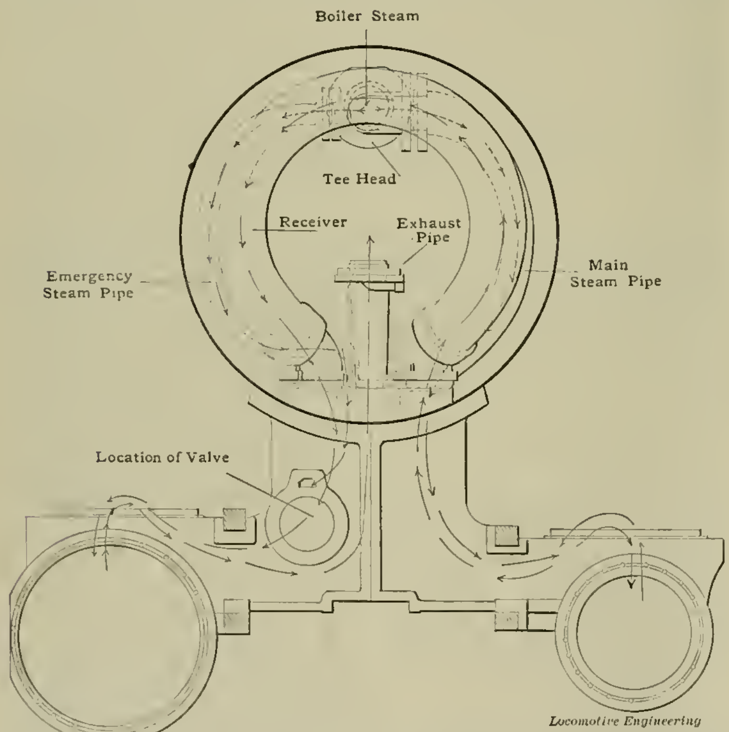
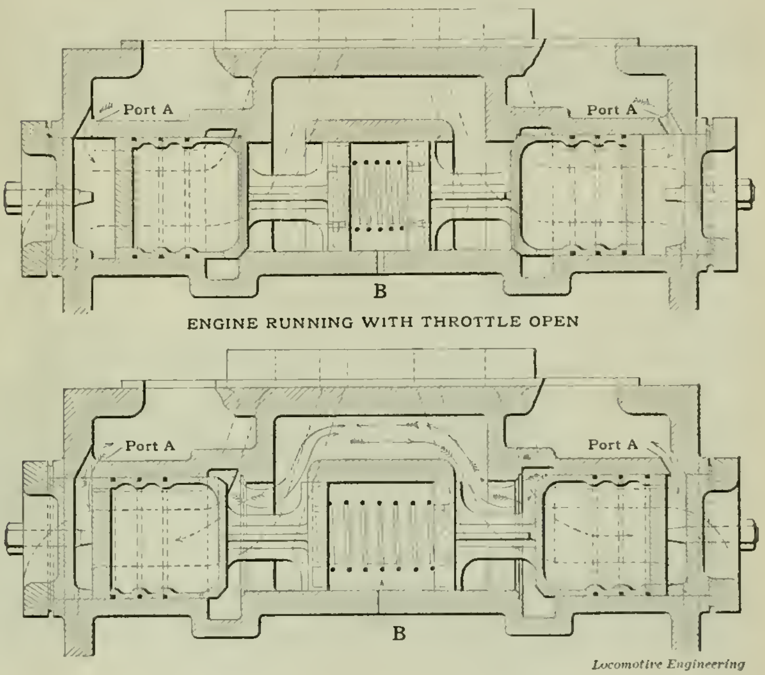


Fig. 1. DIAGRAM SHOWING STEAM CONNECTIONS AND STEAM CURRENTS WORKING COMPOUND.

The intercepting valve *V* is shown in compound position in the sectional view, Fig. 3, in which the passage *G* to the low-pressure cylinder is open to the receiver *F*, and steam has an uninterrupted communication with the valve to the low-pressure cylinder. In starting, the engine receives steam in the low-pressure cylinder at the same time as in the high-pressure cylinder, and therefore starts automatically as a simple engine; the steam for the low-pressure side passing into port *C* from the passage *A*. The receiver at this time being without pressure, offers no resistance to the pressure in port *C* on the shoulder *E* of the reducing valve *L*, shown at the left of the cut, and which is a sleeve on the stem of valve *V*. This pressure moves the valve *L* and the intercepting valve *V* to the right, admitting steam at a reduced pressure to the low-pressure steam chest *G*, as shown in Fig. 4, and at the same time closing the receiver *F* with the intercepting valve *V*. When the engine has made one or more revolutions and the receiver *F* is under pressure from the exhaust of the high-pressure cylinder, this pressure on the receiver side of the valve *V* forces the latter to the left and closes the reducing valve *L*, thus cutting off steam from port *C* and opening the passage between the receiver and the low-pressure steam chest, as shown in Fig. 3, when working compound.

When the engine is required to give maximum draw-bar pull, steam is admitted from a three-way cock in the cab to the piston of emergency valve *H*, holding it open against the tension of its spring. Opening this valve exhausts the cavity *J* where the pressure is equalized with that of the receiver through holes in the right of valve *V*. This valve being then unbalanced, is forced to the right, and with it the reducing valve *L*, which takes steam by shoulder *E*. This position of the valves *V* and *H* allows the high-pressure cylinder to exhaust directly into the main exhaust passage through the emergency exhaust, as shown in Fig. 4, when working simple. The reducing valve *L* being open, the low-pressure steam chest receives live steam from port *C* at a reduced pressure.

Fig. 2 shows the overpass valves used on the low-pressure cylinders of these engines, to admit air from one steam port to the other when running shut off. The valves are placed in the cylinder casting under the steam chest. They are made of piston form with conical seats, the two ports at the ends communicating with the steam chest. In running with the throttle open, as shown in Fig. 4, steam chest pressure is against the valves, entering through ports *A A* and forcing the valves to their seats, thus closing the passage from end to end. When running shut off, the vacuum formed in the steam chest, aided by the spring shown between the valves, forces the latter apart and away from their seats, allowing a free opening of the air ports, and thus an unobstructed passage for air from one steam port to the other.



ENGINE RUNNING WITH THROTTLE OPEN

ENGINE RUNNING WITHOUT THROTTLE OPEN

Fig. 2.

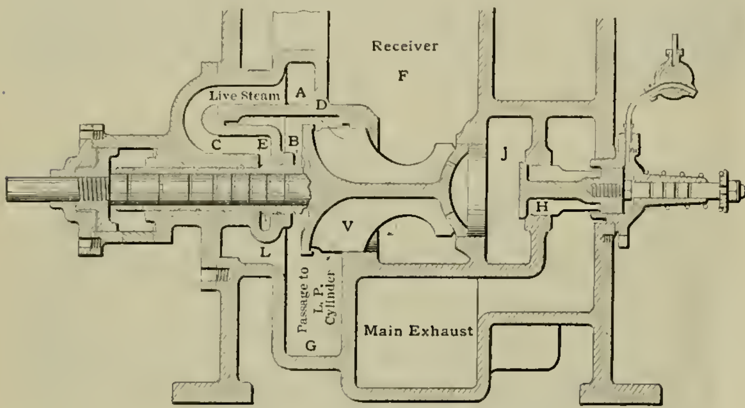
The builders have recently designed and patented an "exhaust pressure relief valve," which is attached to the exhaust port of the low-pressure cylinder; this valve having for its function a reduction of the pressure of the air exhausted through the nozzle when the engine is running with a closed throttle.

The Firemen's Brotherhood is evidently made of the right stuff. Any member who goes to war can feel that his family is provided for by his insurance, the same as if he were hurt or killed in his regular work. We presume the other orders will follow suit.

An exceptional opportunity to educate themselves is afforded locomotive engineers and firemen by the International Correspondence Schools, Scranton, Pa. By studying with this institution, they can, without leaving home or losing time from work, secure a first-class education in the theory of their work and fit themselves for advancement and better pay. The terms are reasonable, and sholarships may be paid, if desired, in small monthly instalments. The schools have students in all parts of the world, and are prepared to refer inquirers to a student in their own vicinity. Circulars regarding the courses and method of teaching may be had on application to the schools by anyone mentioning LOCOMOTIVE ENGINEERING.

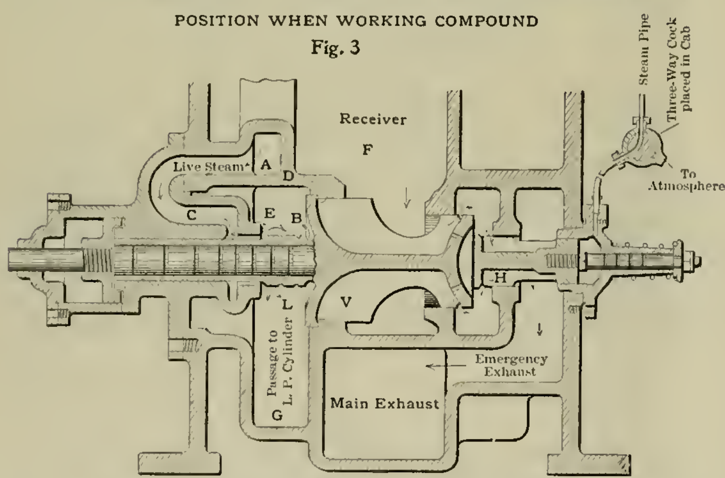
Sunset is the name of a new monthly magazine, published by the passenger department of the Southern Pacific Company, for the purpose of telling the traveling public about the attractions which can be reached by the Southern Pacific Railroad. It contains a variety of interesting reading for travelers, and many very striking half-tones of Pacific Coast scenery. The magazine may be obtained for 50 cents a year from the office of publication in San Francisco, Cal.

The Falls Hollow Staybolt Company write us: "On May 20th, Mr. J. W. Addis, Superintendent of Motive Power of the Texas & Pacific Railway, advised us that he specified our safety hollow staybolt iron on the ten new locomotives that are to be built by the Rogers Locomotive Works. We are pleased to add that the Rogers Locomotive Works placed the order with us this week for the staybolt iron. Many of the railroad companies are discontinuing the practice of drilling or punching their stay bolts, as they find the Falls Hollow Bolt is not only more economical at first cost, but more lasting and better in every way."



POSITION WHEN WORKING COMPOUND

Fig. 3



POSITION WHEN WORKING AS SIMPLE ENGINE

Fig. 4

INTERCEPTING VALVE OF RICHMOND COMPOUND.

We have received from the Peggy Company, of Cincinnati, a small case for holding chewing gum, which is reported to be very popular with those who partake in the indulgence which the contents of the case provide. Those who wish to obtain this new luxury can have their desires gratified by sending five cents to the makers.

H. W. Johns & Co., New York, have issued a railroad edition of their illustrated vulcabeston catalog. It is a small publication, convenient for the pocket, and contains a great deal of useful information about packing and other matters where vulcabeston and asbestos are used.

The Graham Equipment Company, of Boston, Mass., have put on the market an automatic draw-bar hight adjuster which we think will be of much value to railroad companies. The device is very simple in arrangement, and appears to be inexpensive. The Graham Equipment Company have issued a small illustrated circular showing the device. Those interested should send for it.

The Q. & C. Company report a large order for McKee brake slack adjusters, just received from New York for shipment to a prominent railway in Peru, showing that the merits of these goods are appreciated abroad as well as in the United States, where they are now in use on thirty-two different roads. They have also just made shipment of one of their largest power sawing machines, No. XXXXX, to Sheffield, England. This machine carries a 36-inch blade and is used for cutting risers and gates off steel castings.

The American steel truck made by the American Steel Foundry Company, St. Louis, which is an improved form of Diamond truck, is making rapid progress into favor. Mr. W. S. Calhoun, the Eastern agent, has lately received large orders for the truck from the Canadian Pacific, the Delaware & Hudson Canal and the Chicago, Rock Island & Pac c.

It is stated the Midland Railway carried 48,000,000 passengers in 1897 without killing one. This safety on railway trains explains how the low rates of railway insurance can be made by reliable companies.

LOCOMOTIVE ENGINEERING
A PRACTICAL JOURNAL of RAILWAY MOTIVE POWER AND ROLLING STOCK.

Vol. XI. NEW YORK, AUGUST, 1898. No. 8.

On the Fastest Train in the World.

It has been my privilege to ride on a great many fast trains in America and in Great Britain. I have a habit of carrying a stop watch and of using it to time the speed between mile posts, which practice has given me positive evidence of the speed attained or maintained.

After watching the speed of celebrated trains in the British Isles, I have at certain times been moved to remark to railway men and others that some trains in America made better time than those of other countries. When I proceeded, by referring to my note book, to give particulars, the best of friends would regard me with a pitying smile which said as plainly as possible "he has acquired skill in the Yankee habit of boasting and lying."

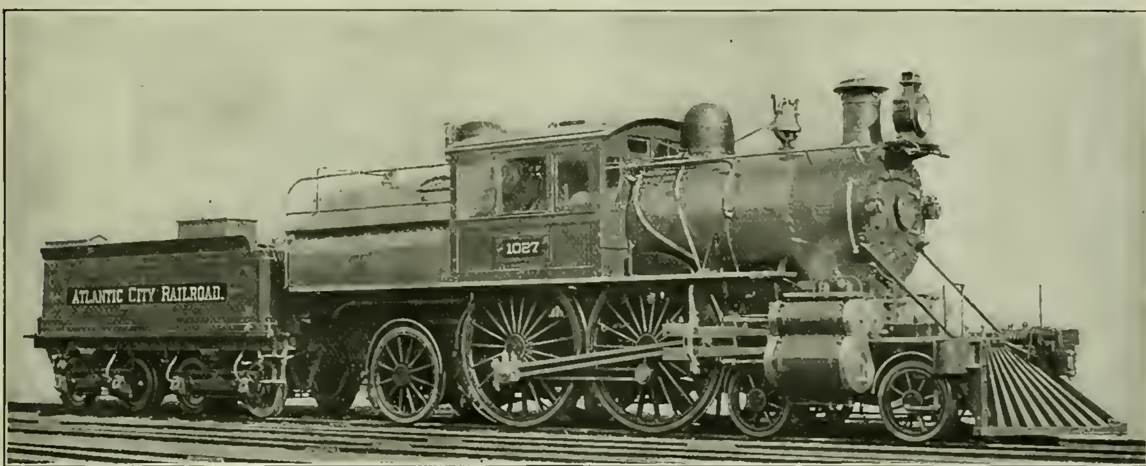
As I am going to be visiting among railway friends abroad for a few weeks I wished to witness for myself the run of the fastest train in the world, that runs from Camden to Atlantic City, a distance of 55.5 miles in 50 minutes, an average speed of 62.2 miles per hour. Through the courtesy of Mr. Theodore Voorhees, Vice-President of the Philadelphia & Reading Railroad, I received permission to ride on the engine of that celebrated train. The train is due to leave Camden, which is across the Delaware River from Philadelphia, at 3:50 P. M., and I was there in good time to witness the preliminary touches given to the locomotive before starting upon a trip that must put a severe test upon various elements of the engine.

Half an hour before starting time the engine was backed up to the train, which consisted of seven passenger cars. I happened to be exceptionally fortunate to take notes of an extraordinary feat of fast train running, for it was the first time that seven cars had been hauled on this train, five or six cars having been the usual load last season. Each car averages 75,000 pounds, and the engine, in working order with tender, weighs about 218,000 pounds, so there were 525,000 pounds of train, making a total of 743,000 pounds, or 371½ tons, to be moved.

I found a crowd of interested admirers about the engine watching every move of the engineer and fireman, both of whom were quietly attending to the duties of preparing the engine to do its work without chance of failure. The engineer, Mr. Charles H. Fahl, kept moving about the engine scanning every part, and dropping a little oil on the parts that needed the greatest amount of lubrication. While I remained watching him he oiled the principal bearings twice, and then carried his cans to the cab, apparently satisfied that his full duty had been performed. The fireman, Mr. John Pettit, was engaged throwing a few shovelfuls of coal at brief intervals into the enormous firebox which has 86 square feet of grate area, and watching at intervals to find a thin spot that needed covering up.

These trains were run for three months last year on the 50 minutes schedule, with the same men on the engine, without a single mishap, or without losing a minute of time. The engine never had a hot pin or bearing, and, in spite of the tremendous work put upon it, was always ready to turn round and take out another train without a minute's delay. That fine record was due to the care in seeing that everything was in good order before the start was made. In conversing with Vice-President Voorhees I found that he attributed the successful running of this train in a great measure to the care and skill of the engineer and fireman.

At 3:50 precisely the signal came to start and the engine moved ahead without slip or quiver. A few turns of the great driving wheels forced the train into good speed and away we rushed out through the yards, through the suburban residences and away past smiling vegetable farms. On reaching the first mile post to



NEW READING FLYER.

be seen, which was about a mile out, I had my watch in hand and the second one was passed in 68 seconds. An interval of 62 seconds brought us to the following post, and then the succeeding notations were 60, 59, 56, 52, 50, 48, 46, 52, 53, 53, 51, 50, 52, 49, 50, 53, 52, 50, 49, 44, 45, 42, 44 seconds for each succeeding mile. Then I made up my mind that the high speed was authentic and put my watch in my pocket the better to note particulars about the handling of the engine.

I was sitting on the fireman's side and could not see how the engineer was handling his reverse lever and throttle lever, but I noticed that there was no change in the point of cut off after the train was going forty miles an hour, and it seemed to me that the steam was permitted to follow the piston a little more than half stroke. The steam pressure gage could be easily noted, and the safety valve blew off at 230 pounds per gage pressure. The fireman appeared to do his best to keep the pressure about five pounds short of the popping point, and he did his work well, but the indications were that he had more difficulty in keeping the steam down to the popping point than in letting it rise. He did not seem to work much on the fire. He watched it very closely, and threw in a few lumps occasionally, but there was no hard work in supplying all the steam needed to do the enormous work of pulling the heavy train at the speed noted. The coal used was small lump similar to house furnace coal.

The road is a little undulating, but the rises and descends seemed to make little difference to the speed. Out through stretches of farm lands, away through spreading woods and moor-like regions of scrub oaks the train rushed along, neither curve nor grade seeming to restrain its velocity. The engine rode with astonishing smoothness. When I have ridden on other engines working hard and keeping up speed over 70 miles an hour, there was always a harsh vertical vibration due probably to the jerk of compression, but that disagreeable sensation was entirely absent in this compound. The work done gaged in horse power per hour was enormous, and perhaps unprecedented for a locomotive, but it was performed with remarkable smoothness, and the impression was always present that the engine still had some margin of power in reserve which could be used if necessary.

About four miles from Atlantic City a signal was against the train and the speed was reduced to about 20 miles an hour before the signal was lowered. That was about three-quarters of a mile from the succeeding mile post. I noted the time from that mile post to the next one and the mile was run in 60 seconds. That will give a good idea of the power of the engine which is shown on our first page.

Two minutes were used in running the last two miles through the switches. At least one minute was lost with the signal check. With these deductions I calculate that the average run was made at a speed of over 70 miles an hour.

A. S.

Annexed are leading particulars of the engine which is shown on our first page.

The cylinders of the engine are 13 and 22 x 26 inches; the drivers are 84¼ inches diameter; the driving-wheel base is 7 feet 3 inches, and total wheel-base 26 feet 7 inches; the total weight is about 142,900 pounds, of which 78,600 pounds are on the drivers. The diameter of the boiler is 58¾ inches, and it contains 278 tubes, 1¾ inches diameter. The firebox is 113⅞ inches long and 96 inches wide, and has 136.4 square feet of heating surface. The tubes have 1,644.9 square feet of heating surface; the total heating surface being 1,835.1 square feet. Tank capacity, 4,000 gallons.

Oil-Burning Locomotive.

The Great Eastern Railway, England, is using some of Mr. James Holden's oil-burning express engines, one of which is shown. The cylinders are 18 by 26 inches; drivers, 7 feet 6 inches; boiler pressure, 160 pounds. The driving wheels have both inside and outside bearing.

The oil fuel is burned with Mr. Holden's patent system, the tank carrying 750 gallons of oil.

ONE OF MR. HOLDEN'S OIL-BURNING ENGINES.

The testing of axles and cast wheels by a falling weight has developed some of the crudest contrivances possible to conceive. Anything seems to be good enough to give the blow, and the question of a proper foundation has no bearing in the matter, or at least not enough to warrant consideration, in a great many cases. Under such conditions, the provisions of an iron-clad specification may be complied with to the letter, but the spirit of the document is buncoed on account of an elastic foundation which effectually takes the energy out of the test drop.

When you're enthusing over the work of our navy, don't forget the engineers and firemen. The gunners are fine, but so are the men down below. If the engineers hadn't been of the best, the Oregon would probably not have made her phenomenal run, both around the Horn and in pursuit of the Cristobal Colon. Let's divide the credit up, so each gets his share.

GROUP OF MASTER MECHANICS' ASSOCIATION AT SCHENECTADY LOCOMOTIVE WORKS.

A Glimpse at Kootenay and Its Wonders.

BY WM. BLEASDELL CAMERON.

Two thousand feet rise in a distance of sixteen miles is something sufficiently infrequent on the line of any railroad to merit more than passing comment. If you listen to a discussion on railroad engineering, when a point has been reached where the description of a particularly difficult or brilliant piece of work is attempted, you are apt to hear a good deal about 3 and 4-per-cent. grades. There are many such grades in the sixteen miles between Rossland and Northport, on the Red Mountain extension of the Spokane Falls & Northern Railway.

To the traveler posted on the rear platform, a 4-per-cent grade is a portentous thing. It looks like an incline of 30 degrees which the locomotive is struggling to overcome. The engine snorts and staggers under the effort like a live creature, frightened at the magnitude of the task before it—the tortuous path and abyss beneath. The wheels grind and creak round the curve on some high trestle, bolted to the flinty wall of the towering mountain, and queer ripples manifest themselves with discomforting persistency along the traveler's spine. It is all very fine, and he would not have missed it; but, having once seen it, he probably resolves within himself that his next trip over this wonderful road shall be in the way of business, and not for pleasure. It is too taxing upon the nerves.

CROWN TRESTLE NEAR ROSSLAND, B. C.

The scenery along the blue Columbia, approaching Northport from Spokane, is very picturesque; in places it is surpassingly beautiful, but it will not compare in sublimity and grandeur with that on the Red Mountain extension.

125-FOOT SPAN NEAR ROSSLAND, B. C.

At Northport you cross the Columbia, here perhaps a quarter of a mile in width. The cars are backed on to an open ferry scow, strung on a steel cable spanning the river. The force of the current drives the scow to the other side. Here another engine is in waiting, you leave the river and in a few moments are winding up the first stiff grade on the Red Mountain branch. High on each side rise the pine-clad mountains, over the brawling watercourses which the line is endeavoring to follow. Far, far up a dark green slope a dot of white twinkles among the trees. Beside it a black speck gapes over a grayish-blue patch. It is the camp of a prospector, with his tunnel or prospect hole near and his "dump" of gray-blue rock below the mouth of it. There must be water somewhere up there; he could never carry it to that uncompromising hight from the distant valley. A tiny thread of white lying on the mountainside from top to foot, near his tent, shows the water. Standing beside it, you would find a noisy stream that you would scarcely try to leap across.

A few miles from Northport, Sheep Creek Fall drops over a precipice into the ravine opposite the track. Then, past it, comes Sheep Creek Cañon. The railroad follows this, and it is a marvelous roadbed here, cut out of the cañon walls and running on the solid rock. Sometimes the sun sinks deep enough into the rift, when the trees do not crowd too closely overhead, to cast a rainbow where a narrow bridge spans the gorge, above

ROSSLAND, B. C., AND "THE LOOPS" BEFORE REACHING IT.

the tumbling foam. There are no stations along here, though occasionally a stop is made at a mine or timber camp, where the Chinese cook is pretty certain to be in evidence.

Having left the cañon and the "boundary," the hills grow yet more lofty. It is 3 o'clock in the afternoon, but the sun has dropped behind their purple tops and the shades of evening fall upon the valley. And now we are approaching "The Loops," and the engine is to make the supreme effort which shall lift its burden to the hight that will enable it to cross through the defile to Rossland, the bull's-eye of the Kootenay. The train is running up a long, broad ravine between mountains sloping on either hand into the sky. Straight ahead is another mountain. At the foot of this the train swings sharply to the right, crosses a trestle bridging a rapid stream and thunders back, but higher, higher always, to the entrance to the ravine. The track, where it first entered the valley, is a good way below, here; to the eye it has shrunken to half its real width. Again the locomotive swings, this time to the left. It is rounding the "Crown Trestle." The wheels ring and creak as they bind against the double-spiked rails; the throttle is wide open; the snorting of the engine echoes down the great, silent valley and through the lesser ones cleaving the hills on every side, and the ripples along the traveler's spine become more assertive and disagreeable than ever. The trestle is passed, once more the train is headed northward, still ascending. It has described a complete "S," and there are two tracks below it now instead of one.

A section boss has lifted his tricycle from the rails to allow the train to pass. He puts it back, takes his seat, gives the car a start, and lets go the handles. It quickly gathers speed, and the handles wildly thrash the air as he coasts down the Red Mountain loops. The wheels of his machine clink over the Crown Trestle. He rattles round the second bridge, and a moment later is flying down the long, sloping track past the O. K. mine at the bottom of the valley. He and his little toy car would make a nice gift for Saint Nicholas to put into the stocking of some future railroad president, could the patron saint of the youngster take them at appearances from the traveler's point of view.

Here a mountain trail leaves the rail and winds, a yellow streak amid the green, far up and along these eternal steeps. It leads to the Jumbo mine—or perhaps to the Monte Cristo, or the Sunset or the Evening Star. The air is rare and thin; distance melts into nearness wherever one looks. The scene is one of enchantment: it is unreal, somehow. This is Nature's playhouse.

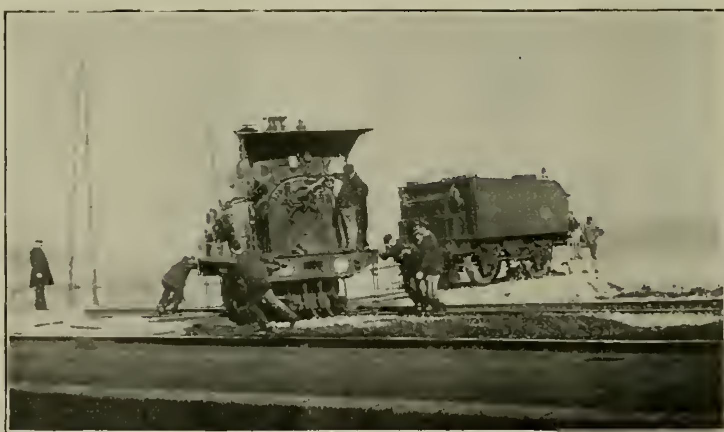
The locomotive whistles shrilly, rounds a curve, slows down and stops with a long sigh of relief. A chaos of new, unpainted, wooden buildings stretches down the side of the mountain below it, and Rossland, the future metropolis of the Kootenay, has been reached.

On nearer inspection, you find that the buildings are not all so unpretentious, nor yet are they all unpainted. There is the Hotel Allen, of stone and brick; the post office and the blocks on the main business street, Columbia avenue. Such structures might not seem out of place in any American town. The general purport of the legends over them, however, will at once arrest the traveler's eye. One-half are the offices of mining brokers and companies—the Gold Bar, Josie, Surprise, Homestake, White Bear, Wonderful, War Eagle, British Columbia Gold Fields Exploration and Mining Syndicate, and so on. In the windows are piles of rock, covering all hues seen in the kaleidoscope. Specimen Jones is here in force—on the street, in the hotels and restaurants (there are fifty of these, though no saloons), on the hills, in the gulches. You are breathing the atmosphere of a consuming, all-pervading greed for gold.

A Canadian ex-Minister of the Interior practices law in Rossland. He is also a police commissioner—hardly as exalted a post as one having the patronage and control of the public lands and mineral department of a country as big as the United States; but when governments change, the circumstances of the men composing them change also, and they must, perforce, doff the garb of state and brush shoulder to shoulder with the great unwashed in the fight for existence. You will find among the treasure-seekers in Rossland men with hyphens in their surnames, whom fortune has eluded in the Transvaal; grizzled knights of the pick and pan from the Sierras, bronzed adventurers from creeks of outlandish nomenclature of the island continent at the Antipodes. Life is cosmopolitan and nakedly democratic. Wealth or success is king.

The mortal part of a man is safer in this raw, throbbing mining camp than in New York. No one "packs a gun." The arm of the law is long and strong in British territory, and there are no "bad" men in Rossland. They are there, plenty of them, but nobody knows them. So long as their deportment patterns respectability they will remain unknown, unnoticed, in this race in which every man is for himself and cares naught about his neighbor. But let one offend, be his offense slight or heavy, and he must fly far and swift but this strong arm will reach to him.

The greatest of the Rossland mines, at present, is the Le Roi. Others may, upon fuller development, prove equally valuable. The Centre Star, Josie, War Eagle, White Bear, Monte Cristo, Evening Star and Columbia and Kootenay are all either upon the same vein as the Le Roi or in its vicinity, and they are all most promising properties. But the Le Roi is the only one which has demonstrated beyond cavil the possibilities of these hills for adding to the world's wealth. It has gone 600 feet into the solid rock of Red Mountain and taken from it 150,000 tons of golden ore. In the two and a half years that the mine has been shipping, it has paid to its shareholders more than half a million dollars in dividends. Twice that length of time since, the stock was in the market at 10 cents a share; to-day the same shares would be snapped up at $8 each—if they were to be had. Other stocks now practically unsalable may have a similar history to show a year or two hence. The ore of the Le Roi runs as high as $400 to the ton in gold, and it averages $40. It is hard and compact, of a beautiful lustrous yellow, with wine-colored strata through it that carry most of the gold.



MONTE CARLO—TABLE TOO SHORT FOR ENGINE WITH TENDER.

Much of the Le Roi ore was, until recently, treated by the Heinze smelter, at Trail, on the Columbia River, seven miles from Rossland. A narrow-gage road runs up to the mine through Trail Creek valley, above which the mining town is situated. Ore from the War Eagle, White Bear and other mines is also treated at Trail. Freight costs $2 and smelting $9 per ton. The Le Roi Company has built a smelter at Northport during the past winter, and the cost of reducing the ore has been materially lessened. The "waste" rock averages in value $16 to the ton.

Years ago, the present Lieutenant Governor of British Columbia, Honorable Edgar Dewdney, surveyed a road for the government west along Trail Creek, which is to-day marked on the map as the "Dewdney trail," and from which, by the way, the creek takes its name. Little did the young engineer guess in that early past, as he set his transit at the base of Red Mountain, that just above him in the hillside lay a mine of gold which in the present year of grace is valued at $5,000,000.

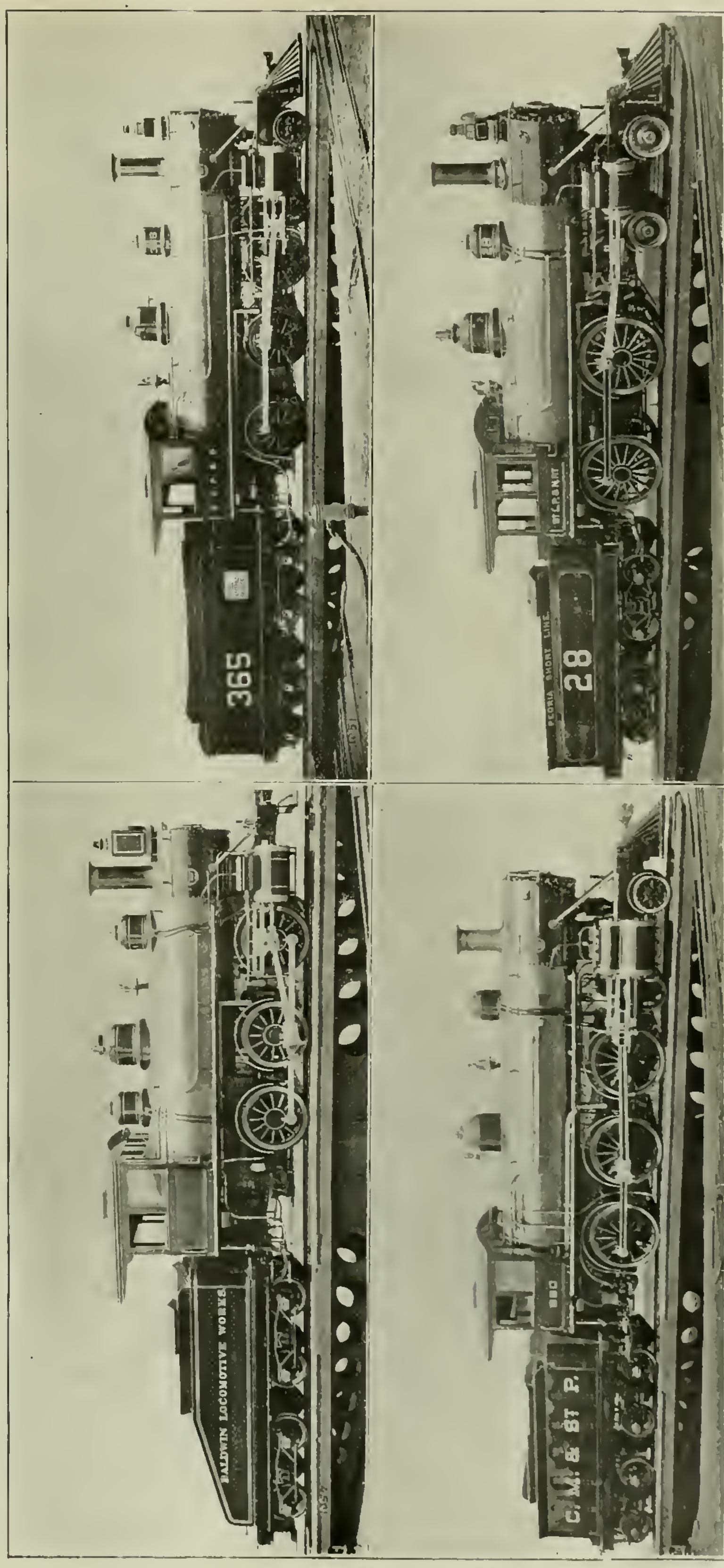
The Le Roi was discovered in 1890 by a Frenchman whose name it bears. Its value was not realized until four years later, and in the meantime it had passed through the hands of a number of owners, in trades or for a pittance.

The Rossland district is but the beginning of the wonders of the Kootenay. At Nelson, also reached by the Spokane Falls & Northern Railway, there is another smelter, and the surrounding hills are rich in mineral. The ore from the Silver King—located in 1886 on Toad Mountain and the pioneer great mine of the Kootenay—is brought down eight miles in tram cable cars to the Hall smelter at Nelson. In some places the ore is "rawhided," slid down the mountains on skins. In the Slocan country, pure native silver is found in several of the mines. At Pilot Bay, Kootenay Lake, there is still another smelter. Sandon and Kaslo have their Payne, Noble Five, Last Chance, Wonderful, Ruth, Ibex, Lucky Jim, their Reco and their Whitewater—all splendid properties. Ainsworth has its Blue Bell and others less celebrated. The Duncan and Lardo districts are untested possibilities, prospected but undeveloped, yet sufficiently known to give promise of as great things as any yet discovered. The Canadian Pacific Railway is pushing through the Rockies into the much-advertised Fort Steele section. Enterprise and activity are the characteristics of the country.

Omaha Exposition Locomotives.

The four locomotives shown on this page constitute the Baldwin exhibit at the Trans-Mississippi International Exposition.

As will be noted, there are two Vauclain compounds and two simple engines. Three of the engines have been built for the service whose names they bear, and the switching engine is for sale at the close of the exposition. They are all very handsome engines and make a very creditable exhibit



OMAHA EXPOSITION LOCOMOTIVES

New Zealand Locomotive and Crew.

A subscriber in New Zealand writes us: "As your valued paper has now a large circulation in the colony of New Zealand, I would like, with your kind permission, to give you an illustration of our method of working express trains in the North Island of New Zealand. Accompanying this I send you a photo of one of our express engines. As nothing of this kind has ever appeared in your columns in relation to New Zealand, no doubt it will prove interesting to our brother engineers here, and also to our American cousins. I may state that we have no Empire State or Black Diamond Expresses here yet, but live in hope of some day outrivaling your fastest trains.

The principal dimensions of this engine are as follows:

Type of engine—Simple four-wheel Cayde.
Cylinders—13 x 20 inches.
Pressure—125 pounds on square inch.
Weight in working order—31 tons.
Capacity of water tank—600 gallons.
Fuel space—56 cubic feet.
Area of grate—8.6 square ieet.
Heating surface—583 feet.
Traction power—7,800 pounds.
Wheels—42 inches.

These engines haul a train of 80 tons weight from Napier to Woodville, a distance of about 100 miles, in 4½ hours. The engineer who appears in the photo was formerly on the Canadian railway, but emigrated to New Zealand some twenty years ago. His name is Robert Durrant. His mate Fireman J. Boyle, and Guard T. Jones, are natives of the Emerald Isle, and a more reliable crew could not be put in charge of a train."

NEW ZEALAND LOCOMOTIVE AND CREW.

Manitoba is to have 500 miles of new road within two years, if possible. It is a link in the long-contemplated Hudson Bay Railroad, which will probably be completed before many years.

A Winans Veteran.

One of the few remaining relics of Ross Winans' Russian enterprise is shown herewith. It is one of the locomotives he built at the "Nickolief Works," established in Russia by him (in connection with the Russian Government) over thirty-five years ago. This is now in service at the Sormovo Locomotive Works in Nijni Novgorod, Russia, and is said to be in good condition. The photograph was sent us by Mr. Henry Stevens, employed by the Sormovo Company.

AN OLD WINANS ENGINE.

Disabling Locomotives.

The engineer has already shown himself in evidence in the Cuban difficulty. At Baiquiri, the landing place of General Shafter's army, was a little railroad which ran to an iron mine nearer Santiago. The Spanish, on deciding to visit friends further inland, tried to demolish a locomotive, but only succeeded in removing a few parts, such as side rods, etc., which were readily replaced. Then the engineers were ready to haul supplies.

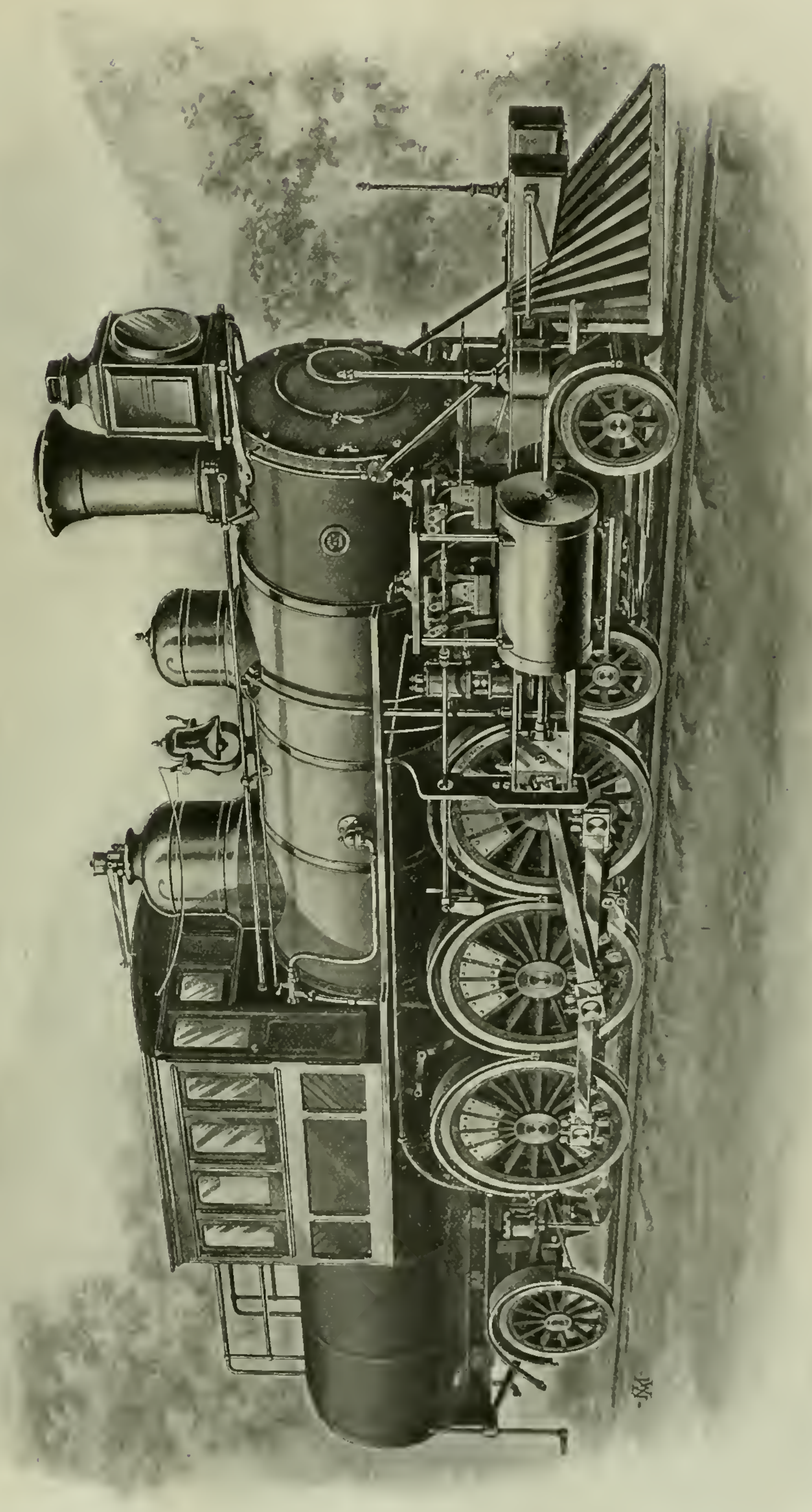
This brings to mind an incident of the Civil War, which shows that whoever did the smashing knew his business. Instead of fooling with side rods or other similar parts, he had taken off the steam chest and valve and quietly put a crowbar into the ports of the cylinders. Then "a long pull and a strong pull and a pull altogether" made the engine about as useless as one can imagine, as an engine with the valve seats and partitions gone doesn't do very much work. When it comes to smashing things, the man who knows how they work gets in his fine strokes.

Fads and Fancies in Locomotive Building—No. 8.

This particular "Strong" engine—for several were built—was made by the Lehigh Valley Railroad at Wilkesbarre, under Mr. Alexander Mitchell's supervision. The cylinders were 20 by 24 inches; the six drivers 62 inches in diameter, and the engine weighed 137,000 pounds in working order, with steam at 160 pounds pressure.

The valves were driven by the "Strong" gear, a combination of a single eccentric and a mess of levers, which was a close approach to several of this type in use at various times. There were four gridiron valves used, two steam and two exhaust, the exhaust valves moving full stroke at all times, and the steam valves cutting off under control of valve motion. This was an approach to stationary practice, which makes pretty indicator cards, but doesn't seem to be practical in railroading.

The firebox was also a novelty—or perhaps freak would better describe it. As can be seen, it was double, and consisted of two corrugated flues joined together at the front end in the boiler shell proper. In appearance it was like a twin sweet potato or a double-barrel water spout, and in practice it did as well as might have been expected, with a result that none of them are in use to-day. Comment is unnecessary. A careful observer has said of this engine that "in every point where it differed from a standard engine it was weak, and to these differences it owed its failure."



FADS AND FANCIES IN LOCOMOTIVE BUILDING—No. 8.

STRONG'S "DUPLEX," 1887.

Indicator Cards from Wisconsin Central Ten-Wheeled Engines.

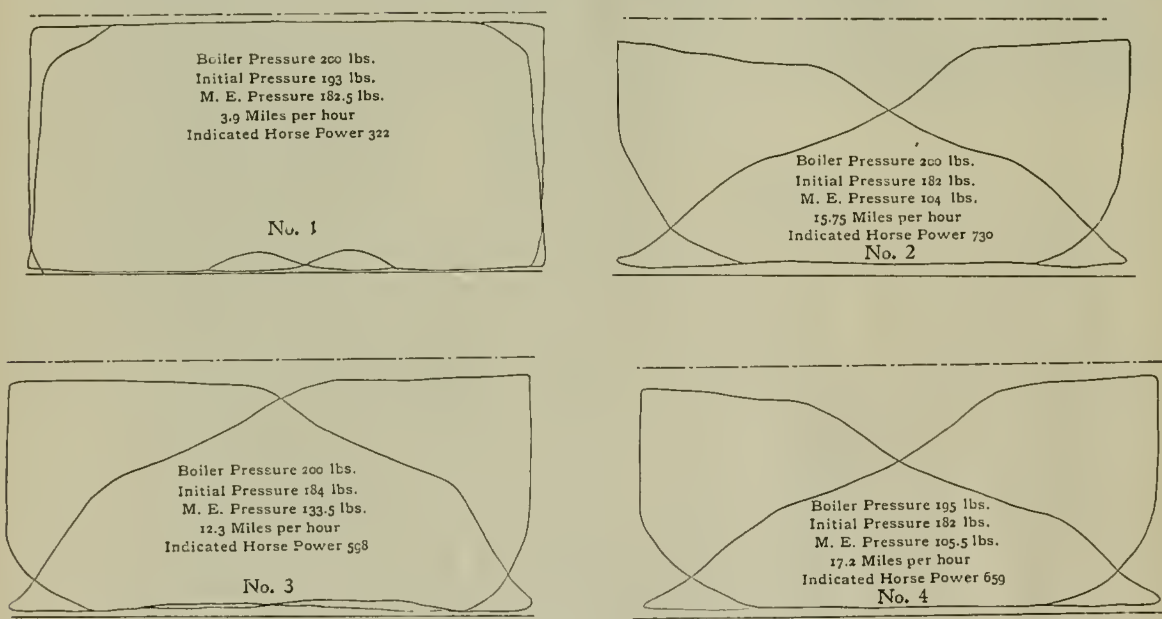
One of the philosophers of this paper recently had the pleasure of assisting in the indicating of the new Brooks engines on the Wisconsin Central, and observing their performance under road conditions in which they were loaded to the limit of their power. The indicator was applied with the sole object in view of portraying the action of the piston valves with which these engines are equipped, and noting the effect of the short steam passages on the initial and mean effective pressures. The valves have internal admission—that is, take steam at the inner edge of the ports, and exhaust at the outer edge, and having a very large port area together with a short distance for steam to travel in reaching the piston, it was expected that these factors would make themselves felt in an increase of power. That this belief was well founded the accompanying cards will show.

The proportion of useful effect realized by the free steam passages, is graphically told by the dotted boiler pressure line in diagram 1, where the initial pressure holds up to 193 pounds, to the point of cut-off. Straight admission lines are not so rare as to cause comment, but the percentage of initial pressure is something worthy of more than passing thought, since it is 96.5 per cent. of boiler pressure. The mean effective pressure is correspondingly good, showing 91 per cent. of boiler pressure. This card was taken from the freight engine, having 20 x 26-inch cylinders and 63-inch wheels, while on a 1-per-cent. grade, and after the kinetic energy of the train had about spent itself on the hill, the engine slowing down to about four miles an hour, with a load of 1,378 tons behind the tender, or 1,494 tons including engine and train. The distribution of the engine while exerting its maximum effort is well shown in the card, and the effect of negative lead is apparent by the rounded corners of the admission line. Clearance on the exhaust is also marked by the late exhaust closure; there was no pound, however, notwithstanding these conditions are favorable to a thump when passing the centers at slow speeds. The hump shows the effect of the single nozzle. Diagram 2 is from the same engine entering the same grade, but with a lighter load, engine and train weighing 1,397 tons. The speed was 15.75 miles per hour, and cut-off at 8 inches. These cards show average calls on the freight engine and represent extremes of conditions actually met. Here, too, the ratios of initial and mean pressures are well up, being 91 and 55 per cent. of the boiler pressures, respectively.

The passenger engine, 19 x 26-inch cylinder and 69-inch wheel, had exactly as severe a trial, by running in freight service, since that was the only way in which a tonnage commensurate with its power could be obtained at the time. Diagram 3 shows what this engine was doing while moving 1,228.5 tons, including her own weight, at a speed of 12.3 miles an hour on a 0.16 per cent. hill. The distribution in this card is practically perfect at 12 inches cut-off, the pressures being as well sustained as in the case of the freight engine, being 92 per cent. for initial and 67 for mean effective, with only 1 pound difference for the two ends of cylinder. Diagram 4 was taken on a level, with the same train, at a speed of 17.2 miles an hour and cutting off at 8 inches, the percentage of pressures being practically the same as in the case of the freight engine at same cut-off.

The causes of these results are found in the immense port area of 36 square inches, and in the short passage from the valve to the piston, which combination insures an almost instantaneous admission, and with it a higher mean effective pressure. It was demonstrated that the shortest cut from valve to piston was more efficacious in producing high mean pressures than tortuous passages, when the gridiron valve was used at end of the cylinder, and the piston valve makes it possible to shorten those passages and corroborate that finding.

The coefficient of adhesion of the freight engine is 0.257, and of the passenger engine, 0.214, taking 90 per cent. of the boiler pressure as mean effective, which is less than found by cards, giving a ratio of adhesion to tractive power of 3.88 for the freight, and of 4.65 for the passenger. It is evident that sand will be required for the first, to get the maximum power out of her in winter, and equally evident that the passenger engine will not give trouble from an ordinary snowy or wet rail. These conclusions are borne out by our observations while with the engines, in which their behavior was closely noted on both wet and dry rails, their performance leaving no opening for criticism.



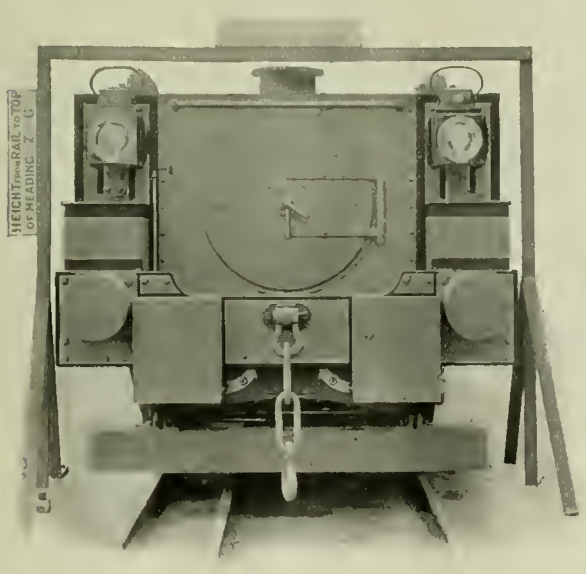
INDICATOR DIAGRAMS FROM BROOKS WISCONSIN CENTRAL ENGINES.

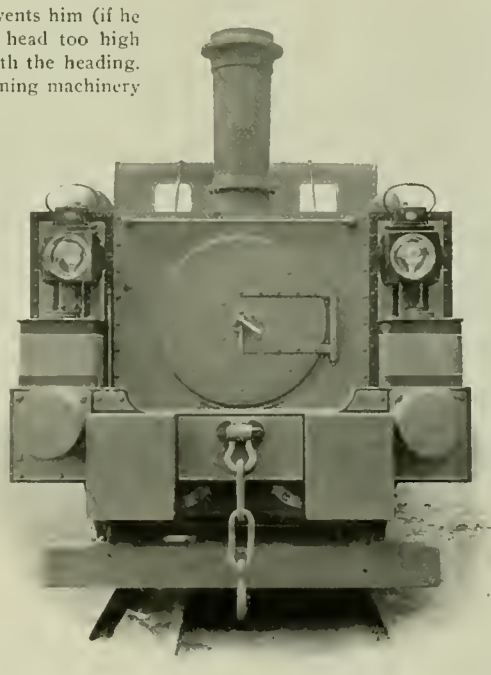
Those who are familiar with valve motion say that Halsey's new book on the subject is the best yet published. It is plainly written and easily understood.

Tunnel Locomotives.

These locomotives were made for working in tunnel headings—having the rather

limited dimensions of 8 feet 6 inches in width and 7 feet 6 inches in hight above level of rails—and also in the open. They are of the standard gage, 4 feet, 8½ inches.





END VIEWS—TUNNEL LOCOMOTIVES.

When working in the open, the chimney, cab fixings, regulator, brake, reversing lever, etc., are as first shown. For inside work the chimney is taken down, and the engines are furnished with two sets of exhaust pipes, the one discharging into the two side tanks, holding 700 gallons of water. The valves for controlling the exhaust are placed in the cylinder castings, and are easily worked by the engineer from his footplate.

In addition to the removal of the chimney and cab fittings, the engineer's footplate is taken away, and the engineer simply steps down on a lower deck. The flat plate over his head is easily fastened into position on four short wrought iron pillars. This covering protects him from falling objects; it also prevents him (if he be tall) from raising his head too high and trying conclusions with the heading. All the handles of the running machinery behind the boiler, including the regulator, reversing gear and the brake, are arranged to be rapidly unshipped and refixed, so as to be suitable for working the engine either in the upper or lower position.

The engines have inside cylinders 11 inches diameter and 15-inch stroke, six wheels all coupled 2 feet 9 inches diameter. The boiler is made of the best mild steel, and the firebox of copper, brass boiler tubes. They are also fitted with a powerful steam and hand brake, acting on all six wheels, all the brake rods being placed above the wheels and out of the way of any damage should the engine run off the track. Four sandboxes, rail washing cocks, lamps and a full set of tools complete the equipment.

Three of these engines rendered valuable service in the construction of the tunnels on the East & West Coast Railway, England. They were built by the Hunslet Engine Company, of Leeds, England.

Baltimore & Ohio Birthday Party.

The corner stone of the Baltimore & Ohio Railroad was laid July 4, 1828. The seventieth anniversary of the event was pleasantly celebrated by a party of newspaper men, who left New York Saturday afternoon, July 2d, on a special train. Mr. J. H. Maddy, general press agent of the Baltimore & Ohio, acted as host, a part in which he has, from long experience, become perfect. The power of the press agent struck awe and envy into the breasts of the party, and several of them are now open for that position, should any well-conducted railroad company desire their services in that capacity. Philadelphia, Baltimore, Washington, Grafton, Cumberland, Deer Park and Pittsburg were the points touched, a pleasant call being made on the Press Club at Pittsburg.

"The Picturesque Baltimore & Ohio" has a world-wide reputation, but many people have had the idea that the conditions under which the picturesque features were seen prevented a proper appreciation of the beauties of the scenery. This may at one time have had an element of truth in it, but large sums of money have been expended on improvements all along the line, and the results are apparent to everyone who has ridden upon the road in the old days. Curves have been straightened, outer rails raised, heavy rails and ballast put in, until the condition of the permanent way leaves no room for criticism.

Hundreds of thousands of dollars have been spent at Cumberland, Martinsburg, Pittsburg, Locust Point and other places. The result of the new equipment, better grades, stronger bridges and careful management, is shown in the fact that the average train load has increased nearly 50 per cent. in the past two years. The company have during that period added to their equipment 150 locomotives and over 14,000 new cars. The Reorganization Committee estimates that the net income for the year ended June 30th will be $7,975,785.

The writer had the seat of honor (the cab) for part of the trip in one of the famous "1300" class, a type of engine the company is justifiably proud of, the full description of which appeared in the November, 1896, issue of this paper.

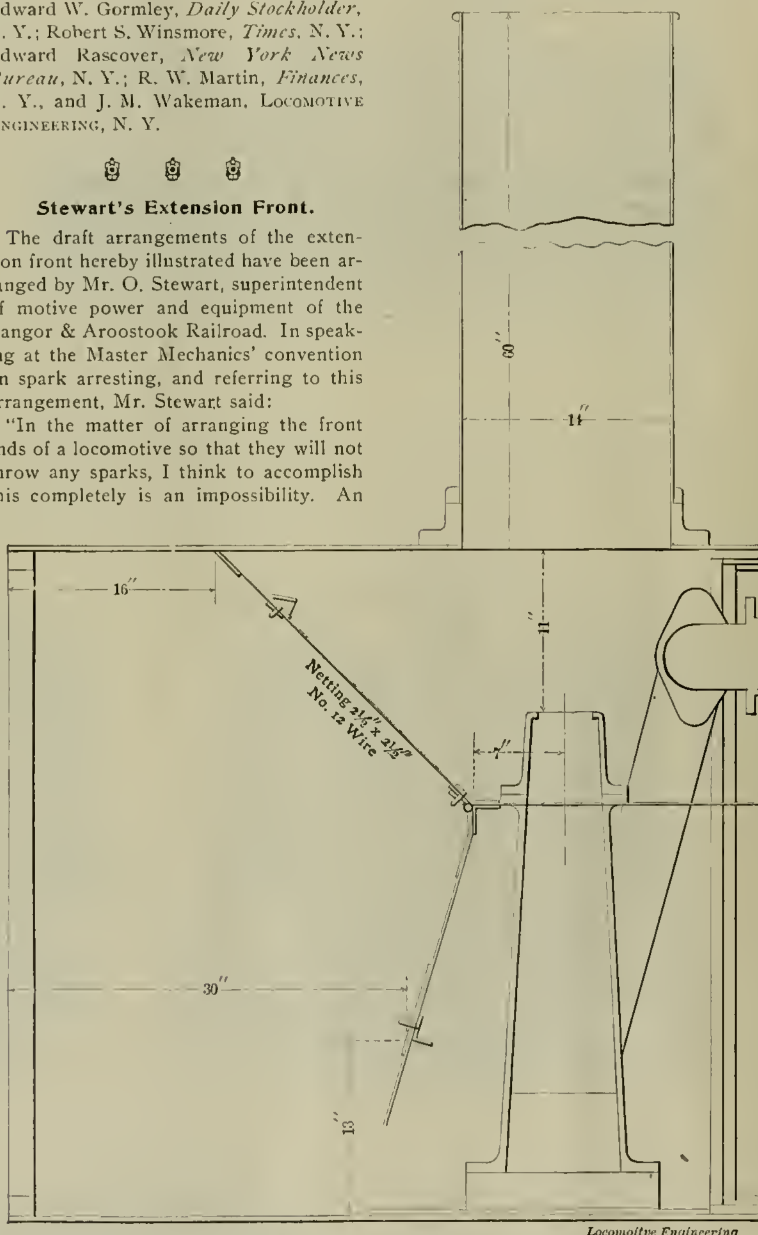
Monday noon the train crossed a bridge which had been burnt down completely less than twelve hours before. The gang of bridgemen were got together at 1.30 A. M., loaded three cars with heavy timber, ran 70 miles, built 104 feet of trestle, and passed this train over 10 hours and 55 minutes after the Maintenance of Way Department were notified of the destruction of the bridge.

The party consisted of the railroad and financial editors of the different papers represented, and included: Harry D. Vought, *Commercial*, N. Y.; F. H. Richmond, *Evening Post*, N. Y.; John H. Brockway, *Standard-Union*, Brooklyn; G. B. Waldron, *Railroad Gazette*, N. Y.; H. E. Hall, *Commercial Tribune*, Cincinnati, O.; John I. Dunn, *Press*, N. Y.; Chas. H Dow, *Wall Street Journal*, N. Y.; John J. Spurgeon and J. H. Leonard, *Mail and Express*, N. Y.; Edward W. Gormley, *Daily Stockholder*, N. Y.; Robert S. Winsmore, *Times*, N. Y.; Edward Rascover, *New York News Bureau*, N. Y.; R. W. Martin, *Finances*, N. Y., and J. M. Wakeman, Locomotive Engineering, N. Y.

Stewart's Extension Front.

The draft arrangements of the extension front hereby illustrated have been arranged by Mr. O. Stewart, superintendent of motive power and equipment of the Bangor & Aroostook Railroad. In speaking at the Master Mechanics' convention on spark arresting, and referring to this arrangement, Mr. Stewart said:

"In the matter of arranging the front ends of a locomotive so that they will not throw any sparks, I think to accomplish this completely is an impossibility. An engine can be made, however, so that it will throw no sparks after the train has once started. Our diaphragms are placed entirely in front of the exhaust pipes, but I have departed from the usual custom of using a low exhaust pipe. I extend our exhaust pipes up to within 12 inches of the bottom of the stack. With a 16-inch engine I use a 4⅛-inch tip; with an 18-inch engine I use a 4½-inch tip. All of our engines clean themselves thoroughly, and after the train is once in motion there are no sparks thrown from the stack. I never allow a fireman to close a furnace door. We run our furnace doors on the latch, with an opening of 2 or 3 inches, and if a fireman brings his engine in with the front end filled up, I want to know the reason why. It is not because the engine will not keep itself clean if properly fired, or if he keeps the hook out of the coal. All of our engines clean themselves thoroughly, but I have not an engine which cannot be filled up at any time. It is a question of the education of the fireman."



STEWART'S EXTENSION FRONT.

Practical Letters from Practical Men.

All letters in this Department must have name of author attached.

Appreciative Words from Australia.

Editors:

Your letter of February 24th, addressed to the locomotive superintendent, has been handed to me by Mr. Campbell, to deal with and reply to.

The suggestion of Mr. Wallington, of South Australia (from whence writer himself hails) is a happy thought, and I am taking it up vigorously, with a view to sending you, at no distant date, a list of regular subscribers in the West Australian Government Railway Department.

You are busy men, I know, and so am I, but I cannot refrain from taking up a small portion of your time in stating how very interested I am, personally, in all matters connected with railway engineering, especially in the discussion of new and useful ideas. No one more fully realizes the truth of your statement, as per advertising dodger, that a man to be worth his salt to the railway department in which he is employed, must post himself in all the newest, smartest and most up-to-date moves on the board. Your paper has been known to me for some eighteen months. I casually dropped on a stray copy sent out as a specimen, and at once came to the conclusion that I had hit upon the "snappiest little paper in the business." An order was immediately placed with a local distributing house for two regular copies. This method, however, is to a certain extent unsatisfactory, and I am more than pleased to have the opportunity of direct communication with you, and of knowing just what procedure to adopt for the future.

It might interest you to know that we have recently started at Perth and Fremantle an institute for railway employés, consisting of reading, smoking, class and lecture rooms, and the interest which has been manifested therein is decidedly encouraging. Needless to say that Locomotive Engineering is very conspicuous on our shelves (the writer's own copy going for the purpose), and so valuable has it become to us that matters under discussion frequently hinge upon its contents, and even decisions are sought from its pages. Now, what could be more gratifying than to find yourself so highly respected in this remote corner of the world?

If not troubling you too much, let me request that you will at all times furnish me with particulars of such new and practical ideas as may concern you and be of interest to us as railway men. You may rely upon any such being vigorously pushed, the motive being actuated by a desire to see your most interesting and useful publication more widely distributed. Acquaintance with them will most certainly bring with it appreciation—and dollars; to you as publishers, and to your readers as tradesmen, mechanics and masters who are alive to their business.

Allow me to present you per same post with a photograph of a recent accident on the Perth-Albany line, which resulted in the death of the fireman and the incapacitation of the driver, who exhibited wonderful nerve and judgment, resulting in the saving of his train and passengers. The cause of derailment was a bullock lying on the line, and as the night was very dark, and the train traveling at a pretty smart rate, it is a matter of surprise how a terrible calamity was avoided.

W. E. Abbott,
Chief Clerk, Loco. Eng. Dept.
Fremantle, W. A.

FELL BY THE WAYSIDE.

Extended Use of Joy's Valve Gear.

Editors:

I have referred to the notice in your issue of June regarding the employment of my gear by the London & North Western Railway Company. May I inform you, however, that as to any abandonment of it by them, this has not been so; and I should know, as my receipt of royalties proves. I assume the report may have arisen from the fact that it is not used on the whole of the engines of the London & North Western Railway; nor could it be—the change of such a vast plant would be impossible—nor even would it be suitable for every case of new design. But in the case in question—twenty powerful engines for heavy and very fast suburban traffic—these are a renewal of the original express goods engine designed by Mr. Webb, and on which my gear was first fitted, and which has been such a successful type that it has been continuously repeated ever since. The present ones are the same, with a pair of wheels added in Mr. Webb's radial axle boxes, to help carry the tank.

But it is worthy of notice, further, that in the new class of large four-cylinder balanced compounds which Mr. Webb is introducing, with very marked success, for heavy and fast express traffic, of which the London & North Western Railway have their share, my gear is again employed.

Also in the case you name, of the London & South Western Railway, where Mr. Drummond has employed it, you have another very large and important move forward for heavy and fast express work, and my gear used.

I could give you more cases, but I have trespassed long enough for the present.

DAVID JOY.

118 Broadhurst Gardens, Hampstead, London.

McLeod's Revolving Check Valve.

Editors:

I send you photograph of a revolving check valve which is self-explanatory and requires but little further description to make its action clear. The curved or spiral wings below the seat give a rotary motion to the valve, while the straight wings above the seat keep the cage clear of scale and sediment, and the center shaft or stem serves as a guide to keep the valve central, and insures a perfect and prompt seating of the valve under all circumstances. Owing to the rotary motion, it is sure to find a different seat each time it closes; and closing with a rotary motion, it has a tendency to grind the seat, which insures a perfectly tight check valve at all times.

This valve can be used in a horizontal as well as in a perpendicular position, therefore can be used for inside or outside checks, and can also be used with or without the cage, and is equally serviceable in all kinds of liquids, gas or air. These

valves have been in use here on our engines for the past eighteen months, and have given perfect satisfaction; such a thing as a leaky or sticking check being entirely unknown, thereby reducing the cost of injector and check repairs to the very lowest minimum. This device is known as McLeod's revolving check valve, being named after the inventor and patentee, Mr. Norman McLeod, general foreman, Peoria, Decatur & Evansville Railway Shops, at Mattoon, Ill. Proprietory interest in the invention is for sale.

WM. BOSLEY.

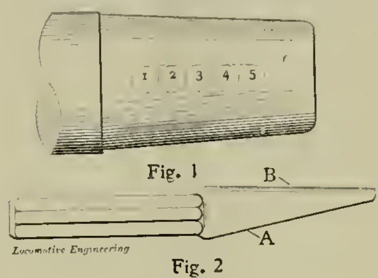
Mattoon, Ill.

Cutting Out Keyways.

Editors:

The slotting of key-ways is not generally much of a picnic, especially when Coffin toughened steel piston rods are used. In shops where this work is done on machines the material does not matter so much, but machining is not a universal practice.

Where the good old practice of drilling and chipping is followed, the chisel shown in Fig. 2 will be found useful. It does not vary greatly from an ordinary cape chisel,



CUTTING OUT KEYWAYS.

the essential part being that the edge *A* is ground square and hardened the same as the point. The back *B* is formed to nearly the same arc as the holes drilled, and the thickness should be about one-sixteenth less than the diameter of the holes drilled. The mode of using is to enter it in hole No. 2, with the edge *A* to the left, and then drive it down, shearing out the lands between 2 and 1 to the center, and then the same with 3 and 2. After all are sheared to the center, the rod is turned halfway over and the work completed from that side.

This method saves time and broken chisels, and will be found worthy of a trial.

FRED. E. ROGERS.

Corning, N. Y.

Spring Equalizers in Locomotives.

Editors:

Your article in the June number of LOCOMOTIVE ENGINEERING upon my remarks at the New England Railroad Club on the locomotive equalizer, requires more than a passing notice.

I entirely agree with you that the equalizer was designed to equalize the shocks, but am sorry to learn that it had been one of your idols. I do not dispute that it is an equalizer of shocks, etc., but object most decidedly to the merit it falsely claims from so many otherwise level-headed mechanics. Let me go into the subject more fully and make a few statements which may appear at first to be entirely irregular, but which are nevertheless facts. We all know the camera has revealed wonderful things the naked eye could never catch. When a boy, I often wondered at the grotesque figures on Chinese fans and umbrellas, but now by the aid of the rapid dry plate in photography we find that the Chinese figures of birds on the wing are true to nature. The Chinese and the camera were right; but because we fail to discover this are they wrong? Every man has his gift—some prophesying, some preaching; mine has been along the line of spring suspension, and I hope you will not put this down to inordinate conceit, when I say that I do not believe there is a man connected with the locomotive department of any American railroad who fully and completely understands the natural laws governing moving bodies poised upon springs and rolling upon an uneven plane.

All moving bodies are controlled by the law of gravitation; then we must overcome that law. "Ah!" I hear you say, "it cannot be done." Well, as Galileo told the Inquisition, it does move! So I say the law of gravitation can and is being overcome every day. "How?" you say. Very simply; but we will come to this later.

The baby, when he first attemps to walk, finds his equilibrium very difficult; but when he does walk, he is as safe as his father, for the same law keeps them both centered to the earth. Were they to fall, they would both drop down; were they to jump up, they would both arrive where they jumped from. Nature has provided man with legs, and it only requires a little experience for him to discover that they will do more than provide locomotion. Should he jump from a safe distance, he finds upon landing that his knees will absorb the upward thrust his body must meet when his feet strike the earth. This is one method of overcoming gravitation, and as it is a feat every man has accomplished at some time in his life, it will give the reader the key to the principle that I shall unfold as we get further into this subject.

The man weighing 180 pounds and the baby weighing 30 pounds must, when they jump, be prepared to have their knees absorb the blow, and they do land more easily for this very knee action. Were they to have their knees stiff, the thrust or shock would have been severe. You can have a better idea of this by springing up from the floor, say 12 inches, and landing with your legs stiff; there will be a decided rattle especially in the jaws, as they are the ones having the most delicate adjustment.

The question of the weight of the man and the boy does not enter into the argument, provided they absorb the thrust with the knee action; but if each were to keep his legs stiff, he would find the jar proportionate to his weight; therefore we find the weight the springs of the locomotive carry have nothing to do with the absorption of the thrusts, providing the springs are proportioned to the load.

In reading a paper recently, written by A. Von Borries, upon "Spring and Equalizer Action in Locomotives," I was greatly surprised that he should consider the load carried as the great factor, whereas the load has nothing whatever to do with the riding. The axles and wheels are to carry the load.

The springs are to absorb the upward and downward thrusts of the wheels as they rise and fall, due to the uneven plane they have to roll over. These thrusts vary in degree, being governed by the inequalities and the momentum.

In looking over the drawings of the earliest locomotives, I find the half-leaf spring was used then as now, and owing no doubt to a lack of understanding of its nature and its limited possibilities, many combinations of equalizers and springs have been produced. For proof of this, one can study the spring suspensions of the most modern locomotives that have been built during the past year. The writer has failed to find any prints made by different railroads showing the same methods of spring equalizations for the same type of locomotive.

J. HECTOR GRAHAM,
Graham Equipment Co.

Boston, Mass.

Letters on Japanese Locomotives.

Editors:

In relation to an inquiry in April number, page 193, by "R. Q.," Marshall town, Iowa, the letters "N. T. K." on Japanese engines are the initials of Nippon Tetsudo Kaisha, the Japanese for Japanese Railway Co.

SAMUEL A. FORBES.

Perth, Scotland.

To Center Driving Boxes.

Editors:

Figs. 1, 2 and 3 show views of a very handy tool for centering driving boxes and laying out the chucking line *T*, Fig. 3.

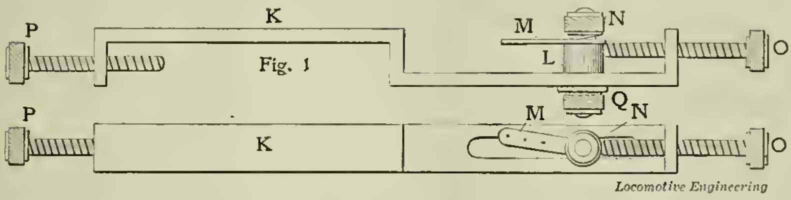


Fig. 2

The fitting of a stick in a box and placing on it a strip of tin and locating on that, in turn, an accurate pricked center, is a job requiring skill, patience and considerable time. This little tool enables a box to be centered quickly and accurately, with no bother with the carpenters or trips to the tin-shop. It is clamped, as shown, by the thumb screw *P* and the stud *L* set at a short distance below the probable location of the center, and clamped by the thumb nut *Q*. The piece *M* is held by the friction of a short coil spring under the nut *N*, or it can be solidly clamped by the same. It has a number of prick marks for the divider points, so that with the available side motion of this piece, and the judicious use

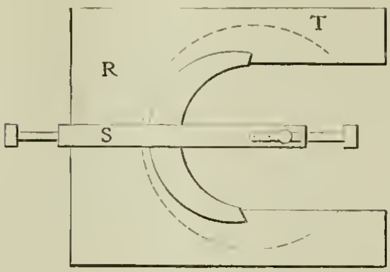


Fig. 3

of the adjusting screw *O*, the center can be quickly found and the chucking line drawn.

FRED E. ROGERS.

Corning, N. Y.

Piston Valves.

Editors:

Piston valves seem to be the style just now in some parts of the country, and are being advocated by some of the best engineers, but it seems to me there are a few points that are not generally considered. As far as being well balanced, if properly made, there is no question in my mind, but aside from being balanced there are other points. Balance I understand to mean, as being in equilibrium regarding an equal pressure in all directions. The amount of friction the valve may have does not affect the question of balance, for if a valve has an equal pressure in both directions, it is balanced, even if the pressure does make friction all around the valve—that is, on the rings. At least that is my understanding of a balanced valve.

It is claimed, and probably with some truth, that the steam gets under the packing rings and forces them out, making friction tending to prevent the valve moving, and judging by the way one piston-valve engine that I know of handled, I'm inclined to believe it strongly.

Then there's the question of clearance. It does not seem to be possible to reduce any lower than with a slide valve, and the latter can be designed to give less than any other form, unless we use a concave valve fitting the cylinder, which is hardly practical.

When it comes to leakage, the piston valve can usually beat anything I ever saw, unless it was Jerry Wheelock's molasses spigots he used for a valve on his first engines. They were supposed to be hung on centers and to be frictionless. As a matter of fact, when they were frictionless they wouldn't hold steam, and when they had a pretence of being tight, they took more power than a slide valve.

The question of steam ports is also to be considered, and after being used to ports as long as the cylinder diameter, it seems strange to see a 12-inch port in a 19 by 26-inch cylinder, for in reality the port is only the diameter of the valve plus the clearance around it.

True, they have ports 2 inches wide against 1¼-inch straight ports, making the full opening area 24 square inches against 23¾ square inches; but when hooked up to the working point, the effective area is less than is usual. This indicates either that the piston-valve area is too small, or the usual area is larger than necessary, and the latter seems most likely.

I am not condemning piston valves, but I do not see any advantage in their use. They are heavy, hard to keep tight, and should give no better results, economically, than a balanced slide valve. But if I was obliged to run piston valves, I would try the marine practice of locking the rings solid, making a solid piston while in use. When leakage occurs, set it out just as we used to set out piston packing, and try again. In fact, I am told that engines are run in England (not many, to be sure) in which the valve is a solid plug with no rings at all. It is said to handle very easily, which can be readily believed.

R. E. MARKS.

Camden, N. J.

An agitation is going on in Pittsburgh, Pa., to have a law passed requiring firemen to pass an examination to show what they know about the principles of combustion before they are employed as firemen. It is believed that a law of this kind would aid materially in smoke-prevention and would help to purify the smoky air of Pittsburgh. A good fireman makes the fuel burn with as little smoke as possible; but when a boiler is so much overtaxed that the fireman must force it all the time, there is certain to be a great deal of smoke created. To the people who are trying to abate the smoke nuisance in Pittsburgh or elsewhere we would commend an investigation of the capacity of boilers and the steam-making conditions that are imposed upon them

Many so-called new devices are really old ones which we have seen and forgotten.

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The Mechanical Draftsman.

The draftsman and his equipment of technical and practical knowledge necessary to fit him for the business seems to be a sort of stock theme, coming up periodically for discussion, which would indicate that it is far from settled just what is required in the attainments of the man at the drawing table to make him the valuable factor that he should be in shop economy.

Those who have been in the business for revenue have had an excellent chance to form some opinions on the subject, and they know that in the preparatory stage of the technical side of the question time was spent on many things that were of little use in their application to shop drawings. The theory of shadows is one of those; angle of projections is another, and they came to a knowledge that skill in handling instruments, while an accomplishment to be proud of, would not put accuracy in dimensions of parts where it is most needed. These are a few things the draftsman will be sure to face at some time in his career, and the sooner they are understood the better for him.

Mechanical drawing in itself presents no barrier that cannot be surmounted by ordinary intelligence, but the application of its principles to shop practice is the beginning of the draftsman's trouble. It is the crucial period in his progress, and success or failure depends on his mental grasp of the situation. This is the time when he comes to realize that his case of expensive instruments is simply a means to an end, and that his ability to handle problems involving the mechanics of machinery and materials must be supplemented with a knowledge of shop work, not necessarily the skill to perform the manual operation of that work, but to know how it is done. If he is built on correct lines, nothing will keep him out of overalls and the shop. It is there only that can be found the information needed to round out and broaden the views of his business, naturally restricted and cramped by the lack of what he sought to know.

After the shop experience, there is no longer any glamour about the drawing office. It is stripped of its tinsel, and thereafter is seen to be simply a useful adjunct to the shop, but one that could be discontinued without materially crippling the resources of the plant; at least so thinks the candidate for shop honors after his return to the scene of his all-theory-and-no-practice days, no longer seeing things from the reflected light of the drawing board.

Experienced draftsmen are plenty enough, and always will be, because the occupation is one to attract and hold a large class that place a genteel calling above most other considerations; but it does not follow, by any means, that because they are experienced draftsmen, they have the kind of experience that will make their service sought after. One well up in stationary engine work would not be at his best in the office of a locomotive building shop, neither would one familiar with the latter work be a jewel in a marine engine shop. They would find their level after a time, but not until they had passed through a sort of apprenticeship, notwithstanding they entered under the head of "experienced draftsmen," and the level found would in all cases be the highest for the man that had the nerve and good sense to fit himself for it by shop training.

The draftsman that is properly equipped with a technical and shop course, is as a dream in the drawing office—he is called to a higher place invariably—and that is as it should be, giving, as it does, encouragement to others lower down. If at any time there is an apparent scarcity of draftsmen in any particular field of mechanical drawing, it may be traced to their elevation, for there is no man better qualified to manage the shop end of a manufacturing enterprise than the one that has mastered the theory and practice of the business; in other words, the mechanical engineer—another name for the draftsman that has an ambition above tracing cloth.

Increasing the Output of Tools.

In our visits to railroad shops we have at times been forcibly impressed with the apparent want of push on the tool side. Purposeless hustle is not meant in this connection, nor break-neck acts. It is the absence of quiet, well-directed effort that is referred to—the atmosphere which is unmistakable with an artist that knows how to remove stock from a job by the best processes familiar to the thoroughbred mechanic.

Antiquated cutting tools, fine feeds and slow speeds, it should be unnecessary to say, have no part in the ideal scheme of production; but they do hold their own in too many shops where the management in other particulars is above reproach, and to an extent that is inexplicable. A most peculiar thing about this adherence to those stiflers of output, is that piece workers—those who would naturally be expected to do some head work, looking to their interests—are as lax in some cases coming under our observation recently as the average tool operator working against time.

It may be said that fear of a cut in their rate of compensation is the motive for keeping the amount of work done within certain limits; but a more rational view of the situation suggests an antipathy for newer and better processes to reach results, through an unwillingness to unlearn old and obsolete practice; although it is a fact that the first proposition has had considerable influence in putting things on a slow basis.

There are a great many railroad shops that are obliged to turn out work with tools that were at their best many years ago, but that fact does not furnish a valid excuse for the fine feeds for which they were specially noted. The idea that they are entirely useless for present-day requirements is one easily exploded by the man who knows their shortcomings and how to surmount the same. Of course no one would advocate the purchase of those old-timers to-day, but there is no question that the bad reputation hanging over many of them is undeserved. As a case in point, we recall an old single-head, rope-feed driving-wheel lathe on which at one time, in our early days, we got in many a ten hours, and ruminated incidentally on our prospects of reaching affluence at the business; as a machine for driving-wheel tires it was simply useless, with its narrow single belt, but when a double belt as wide as the cone would take was applied, the capacity of the machine went up at once, and on such work as boring truck wheels or driving-wheel centers, many of the tools of to-day would not be able to work in a time scoop on the old thing, because it was pushed.

The double belt is one of the best stiffeners for a weak tool that can be applied. It is a sovereign remedy for a chronic light-cut man, because it deprives him of his stock complaint, that the tool will not carry a heavier cut or feed. Our experience with light tools has shown that while the springy features are not easily eliminated, there is yet a margin for an increased output by attention to belting and the character and grinding of cutting tools used. Tools that will remove the maximum of material with least frictional resistance, and retain their cutting properties the longest, are what is required in connection with the double belt. Such a combination may be worked to advantage in shops afflicted with old heirlooms that cannot be replaced by better tools.

Automatic Couplers.

England is passing through the same agitation for automatic couplers, that tore up this country a few years ago. The same arguments are used for and against, and the friends of it there are just as vehement in their demands that the practicability and efficiency of the automatic coupler be shown. It is not clear how such a showing can be made without a trial of them, unless our cousins accept the results attained in this country; this, we believe, ought to be satisfactory to them; they have certainly been so to us.

That the automatic coupler is an improvement over the link and pin, no one will deny, and yet the old form of coupling would have continued in its work of maiming and killing, but for the interposition of the law, which made it compulsory on the part of the railroads of this country to equip their cars used in moving interstate traffic with "couplers coupling automatically by impact, and which can be uncoupled without the necessity of men going between the ends of cars."

The sluggish action taken by the railroads here to meet the requirements of the above enactment, is shown by the fact that the law was approved in March, 1893, and January, 1898, was named as the limit for equipment of all cars, a period of four years and ten months, which would seem to give the railroads interested ample time. As a matter of fact, there were but a few roads that had complied fully with the law at the beginning of 1898, and an extension of time has been granted, so that if on the expiration of the grace given, the cars are fully equipped, there will have elapsed a period of about seven years from the framing of the enactment to the satisfaction of its provisions.

Public sentiment is a very potent factor in shaping the action of corporations in the matter of safety appliances, and it has shown its influence in this country in forcing the adoption of the air-brake on passenger trains, and among other life-saving devices, perfected systems of signalling; but it remained for the strong arm of the law to make the use of the automatic couplers compulsory, and give the trainman a longer chance with life and limb. England would do well to let the sentiment end of the question rest, and cultivate the good-will of the law-makers, if she desires to get rid of the screw coupling.

Great Combination of Assurance and Ignorance.

A car interchange dispute recently settled by the Arbitration Committee of the Master Car Builders' Association lets the world know that there is a railroad somewhere called the New York, Texas & Mexican Railway. We do not find the company mentioned in any of the official lists, but there is doubtless a railroad of that name, and it has some officers who are endowed with phenomenal cheek. Two cars belonging to other companies were on a siding belonging to this New York, Texas & Mexican Railway, and were blown out through a wind storm and destroyed. Instead of quietly paying the damages incurred by their own carelessness in not having the cars properly secured in the siding, the men responsible for the damage protested that they were not responsible for damage done by a wind storm, and not only refused to send the cars back as good as they received them, but wanted to have charges guaranteed for shipping the trucks.

It is the most unscrupulous case of combined ignorance and assurance that we ever heard of. The men in charge showed their incompetency by not having the means of keeping the cars safely on the side track, and then they displayed the grossest ignorance by pretending that they were not responsible for damage done.

Unfair Express Companies.

When ordinary firms or corporations become so imbued with selfishness that they lose all sense of justice or fair dealing, they generally encounter checks of various kinds which convince them that unscrupulous business methods do not pay. An exception to this rule seems to prevail with the express companies. These companies take to themselves a vast amount of revenue that rightly belongs to railroad companies, and while basing rates on what the business will stand, there is nothing done to restrain their grasping tendencies. Legislatures are always fighting railroad charges which are near cost of work done, but no one ever tries to restrain express charges to lines of moderation when they are known to be excessive.

Since the war broke out, most of the people who have to pay increased taxes have stepped under the new burden with cheerfulness; but not so with the express companies. The new law says that it shall be the duty of every railroad or steamboat company, carrier, express company or corporation or person, whose occupation is to act as such, to issue to the shipper or consignor or his agent or person from whom any goods are accepted for transportation a bill of lading, manifest or other evidence of receipt and forwarding for each shipment received for carriage and transportation, and to each bill of lading, etc., and to each duplicate thereof, shall be attached a stamp of the value of one cent. All the interests involved, except the express companies, have acquiesced to the requirements of the law; but the express companies are determined to make their customers pay the tax.

They are not, however, going to have their own way as easily as they generally do. The Merchants' Association has decided to begin a test case as soon as papers can be prepared for the purpose of ascertaining legally whether merchants forwarding packages by express companies or carriers should pay the stamp tax on each package, or the express companies or carriers should pay it. It is to be hoped that the agitation resulting from this case of unfair dealing will direct public opinion to the habitual unfairness of express charges.

Electric Headlights.

Exceedingly persistent efforts have been made to push the electric headlight into use on locomotives, but very little progress has been made, considering the energy of the promoters of this kind of light. Inquiries among men who have ridden behind the present form of electric headlight have elicited the statement that the light is too intense; the engineer who has been watching the track illuminated by it is affected very much in the same manner as the person who steps from a brilliantly lighted room into a dark hallway—that is to say, the contrast between the brilliancy of the light and the surrounding darkness is so great that it takes some time to accustom the eyes to the change, thus rendering it impossible for the engineer glancing from the track to a signal to distinguish the latter.

It is also claimed that cattle on the track are so paralyzed by the effect of the intense light that they make no effort to leave it, but stand bewildered, the light blinding them so that they are unable to see into the darkness beyond, and are afraid to step out into it.

These are the objections raised by the men called upon to use them, while of course the officials object to equipping their locomotives with so expensive a headlight unless they can see some good practical advantage in it, which so far has not been demonstrated.

Claims are advanced that such and such accidents would not have occurred, had the locomotive been equipped with an electric headlight. Such claims, however, are entirely problematical, and it is a fact that more accidents caused by obstacles upon the track take place in daylight than at night.

BOOK NOTICES.

"Heat and Steam." By Prof. C. H. Benjamin. Published by Chas. H. Holmes, 2303 Euclid avenue, Cleveland. $1.25.

This is a second edition of this useful little work, which condenses into fifty-eight pages, including tables, about all that it is necessary for a student to know of thermodynamics. It is clearly written, and with the exception of a little calculus in chapters 4 and 5, is fairly plain sailing for the average student. It is an agreeable change from the exhaustive text-books which are generally used, and to those who are after knowledge of thermodynamics it is heartily recommended.

"The General Manager's Story." By Herbert E. Hamblen. Macmillan Company, publishers, New York. $1.50.

The author tells what purports to be the story of the various experiences and struggles of a general manager, but it is rather difficult to believe that all the accidents and incidents mentioned ever befel any one railroad man. The story is interesting, however, and will bring back many recollections to the older railroaders, as the author describes the wrecks, the lay-offs, and the action of the various officials with whom he had to deal. The illustrations add much to the vividness of the story, and the book ought to be popular with railroad men.

"Stromberg's Steam User's Guide and Instructor." By Wm. Stromberg. Published by Geo. A. Zeller, St. Louis, Mo. $1.50.

This is a convenient book of 193 pages, containing a collection of facts relating to steam engineering, much of which is given in the form of a catechism. In addition there are descriptions of injectors, steam pumps, dynamos, Corliss valves, etc., which ought to interest a stationary engineer. There are numerous illustrations which tend to make the text clearer, and there is much to commend the book to studious engineers and firemen of stationary engines, for locomotives are not dealt with. There are, however, many points of interest to any engineer.

"The New Roadmaster's Assistant," by George H. Paine. Published by *The Railroad Gazette*, New York. $1.50.

There are few books on this subject that are so well known as the original Roadmaster's Assistant, by Huntington, and afterwards revised by Latimer, and as this is what might be called a re-written revision of that, it starts with a ready-made reputation. It contains nearly three hundred pages, has 259 engravings, and seems to be a very complete work for engineers, roadmasters and section foremen, serving as a manual for references as to modern methods. The illustrations are very clearly printed, and give a good idea of modern practice in track laying, ballasting, etc.

"D. A. Low's Pocket Book for Mechanical Engineers." Longmans, Green & Co., New York. $2.50.

As the title indicates, this is a pocket book for mechanical engineers, and its 740 pages (4 by 6 inches) are filled with data of this class. The author is a well-known authority, which vouches for the practical value of the book, while the method of treatment seems to be very clear and well illustrated where necessary.

American practice is considered to some extent, the Baldwin Locomotive Works being quoted on standard specification of materials for locomotives. Altogether it is a book which will be of value to anyone interested in mechanics and who wishes a reliable book of reference.

"The Indicator Handbook—Part I.," by Chas. N. Pickworth. Published in America by D. Van Nostrand Company, New York. $1.50.

The author has given in this volume a brief history of the indicator, showing many of its forms. It also treats of its attachments for reducing motion of cross-head, and shows plainly which are best and why they have advantages. The errors of the instrument are shown, and a chapter on the use and care of it gives many useful hints. The second part is to treat on the indicator diagram and its analysis.

PERSONAL.

Mr. John T. Gill has been appointed air-brake instructor on the Grand Trunk Railway.

Mr. W. B. Yereance has been appointed secretary to Vice-President J. D. Layng, of the West Shore.

Mr. M. S. Curley has been appointed master mechanic of the Illinois Central shops at Water Valley, Miss.

Mr. William Rees has been appointed general master mechanic of the Inter-oceanic Railway; headquarters at Puebla, Mexico.

Mr. James A. Egan, terminal foreman of the National Railway at Toluca, Mexico, has been appointed terminal foreman at Oaxaca.

Mr. S. C. Boutelle, master mechanic of the San Diego, Pacific Beach & La Jolla Railway at San Diego, Cal., has resigned on account of ill health.

Mr. T. W. Hansell has been appointed superintendent of machinery of the Astoria & Columbia River Railroad; headquarters at Astoria, Ore.

Mr. James Bruce has been appointed road foreman of machinery for the Western division of the Northern Pacific; headquarters at Tacoma, Wash.

Mr. J. E. Price, division superintendent of the Intercolonial Railway at Truro, N. S., has been promoted to the position of assistant general manager.

Mr. C. E. Lamb has been appointed master mechanic of the Kansas City, St. Joseph & Council Bluffs Railroad, with headquarters at St. Joseph, Mo.

Mr. Lem De Long has been appointed foreman of the Oakdale division of the Cincinnati, New Orleans & Texas Pacific Railway at Hunnicutt, Tenn.

Mr. William C. Winter has been appointed assistant superintendent of the Union Pacific at Omaha, Neb., succeeding Mr. R. R. Sutherland, resigned.

Mr. W. H. Gridley has been appointed superintendent of the St. Louis, Peoria & Northern, succeeding Mr. L. S. Graves, resigned; headquarters at Springfield, Ill.

Mr. William Cotter has been appointed superintendent of the Western division of the Grand Trunk, succeeding Mr. A. B. Atwater, resigned; office at Detroit, Mich.

Mr. C. G. Herman, master mechanic of the Cornwall Railroad at Lebanon, Pa., has resigned, and will resume his old position with the Baldwin Locomotive Works.

C. W. McCord, Jr., died at Auburn, N. Y., on June 5th, of appendicitis. Mr. McCord was a promising young mechanical engineer. He was the author of "Slide Valves."

Mr. James M. Herbert has been appointed superintendent of the Eastern division of the Grand Trunk, vice Mr. Wm. Cotter, transferred; office at Montreal, Que.

Mr. Edward D. Seitz has been appointed purchasing agent of the Louisville, Evansville & St. Louis, vice Mr. W. W. Wentz, Jr., resigned; headquarters at Louisville, Ky.

Mr. W. W. Lowell has been appointed division master mechanic of the Hannibal & St. Joseph Railroad, with headquarters at Brookfield, Mo., in charge at that point and west thereof.

Mr. A. B. Atwater, superintendent of the Western division of the Grand Trunk, has resigned to accept the position of assistant general superintendent of the Michigan Central.

Hereafter Mr. Richard H. Soule will act as Western representative of the Baldwin Locomotive Works at Chicago, and Mr. C. A. Thompson, of St. Louis, as Southwestern representative.

At a recent meeting of the directors of the Detroit & Lima Northern, Mr. Chas. N. Haskell was chosen first vice-president, with full charge of the operating and construction departments.

Mr. P. J. Nichols has been appointed superintendent of the Omaha Bridge & Terminal Company at Omaha, Neb. He recently resigned as general superintendent of the Pacific division of the Union Pacific.

Mr. Angus Brown, master mechanic on the Northern Pacific at Livingston.

Mont., has been appointed superintendent of motive power of the Wisconsin Central at Waukesha, Wis., vice Mr. McNaughton, resigned.

Mr. W. Rennels, division superintendent of the Intercolonial Railway at Campbelltown, N. B., has been transferred to the same position at Truro, N. S., in place of Mr. J. E. Price, promoted.

Mr. D. M. Philbin, general superintendent of the Duluth, Superior & Western, has been made second vice-president of the Eastern Railway of Minnesota. This was brought about through the purchase of the former road by the latter.

Mr. H. S. Rearden has been appointed general superintendent of the Detroit, Toledo & Milwaukee, with headquarters at Toledo, O., taking the place of Mr. N. K. Elliott, resigned. Mr. Rearden was formerly superintendent of the Chicago, Peoria & St. Louis.

Mr. E. D. Dorchester, assistant general manager of the Velasco Terminal Railway, has been made general manager, with headquarters at Velasco, Texas, vice Mr. L. L. Foster, who resigned to accept the presidency of the Agricultural and Mechanical College of Texas.

Mr. W. E. Chamberlain has been appointed general manager of the New York, New Haven & Hartford. A few months ago he was appointed general superintendent of the Old Colony system of that road, with headquarters at Boston, and previous to that was assistant superintendent of the New York division.

The following changes have been made on the Northern Pacific: Mr. William Clarkson, master mechanic at Missoula, Mont., has been transferred to Livingston, Mont., vice Mr. Brown; Mr. F. P. Barnes, general foreman at Brainerd, Minn., succeeds Mr. Clarkson, and Mr. Harry Lyddon, general foreman at Mandan, N. D., succeeds Mr. Barnes.

The following changes are reported on the Pennsylvania Railroad: Mr. P. A. Bonebrake has been appointed superintendent of the Indianapolis division, vice Mr. F. G. Darlington, resigned; office at Columbus, O. Mr. B. W. Taylor has been appointed superintendent of the Louisville division, vice Mr. P. A. Bonebrake, transferred; office at Louisville, Ky.

The numerous friends of Mr. W. E. Symons will be pleased to learn that he has been appointed superintendent of motive power of the Plant system, with headquarters at Savannah, Ga. Mr. Symons was for years master mechanic of the Atchison, Topeka & Santa Fé at several places, and for the last year or two has been connected with the Galena Oil Company, where he made hosts of friends.

Mr. H. N. Webber has resigned as division foreman of the Oregon Railway and Navigation Company at Starbuck, Washington, to be general foreman of Maine Central shops at Waterville. Though but forty-two years old, Mr. Webber has been twenty-five years in actual locomotive service, having been a journeyman machinist at the Mason Locomotive Works, fireman and engineer on Maine Central, division master mechanic and general master mechanic. This ought to be an incentive to young men, as it is the result of personal effort.

EQUIPMENT NOTES.

The A. Knable Company are having four cars built at the Erie Car Works.

The Houston, East & West Texas have ordered fifty freight cars from Pullman's.

Forty Rodgers ballast cars are being built at the Wells & French Car Works.

The Erie Car Works are building six cars for the Germania Refrigerator Company.

The Michigan Peninsular Car Works are building 250 cars for the Flint & Pere Marquette.

One thousand freight cars are under construction at Pullman's for the Chesapeake & Ohio.

The Terre Haute Car Company are building 500 freight cars for the Pennsylvania Railroad.

The Rogers Locomotive Works are building four six-wheel connected-tank engines for China.

The Newfoundland Railway have placed an order for two passenger cars with the Barney & Smith Company.

The International & Great Northern are having 200 cars built by the Missouri Car & Foundry Company.

The McCaw Car & Manufacturing Company have ordered five cars from the Murray, Dougal Car Company.

The Rogers Locomotive Works are building fifteen six-wheel connected engines for the Missouri Pacific.

Ten six-wheel connected engines are being built at the Cooke Locomotive Works for the Missouri Pacific.

The Baldwin Locomotive Works are building one six-wheel connected engine for the Louisiana & Arkansas.

The Western Equipment & Car Company are having twenty-five cars built by the Illinois Equipment Company.

The Southern Railway Company have ordered four consolidated engines from the Baldwin Locomotive Works.

Seven six-wheel connected engines are being built for the Northern Pacific at the Schenectady Locomotive Works.

The Big Four are having four eight-wheel passenger engines built at the Schenectady Locomotive Works.

The Western New York & Pennsylvania are having twenty-five freight cars built by the Buffalo Car Company.

The Alabama & Vicksburg are having one eight-wheel connected engine built at the Baldwin Locomotive Works.

The Minneapolis, St. Paul & Sault Ste. Marie are having twenty cars built by the Russell Wheel & Foundry Company.

The Mt. Vernon Car Manufacturing Company are building 270 freight cars for the Choctaw, Oklahoma & Gulf.

Two engines are under construction at the Baldwin Locomotive Works for the San Francisco & San Joaquin Valley.

The Illinois Car & Equipment Company are building thirty-five freight cars for the Brainerd & Northern Minnesota.

Three refrigerator cars are being built at the Michigan Peninsular Car Works for the Cudahy Refrigerator Car Company.

The Brainerd & Northern Minnesota have ordered two six-wheel connected engines from the Richmond Locomotive Works.

The Wheeling Belt & Terminal Company are having one six-wheel connected engine built at the Pittsburg Locomotive Works.

The Wabash are having three passenger cars built by the Barney & Smith Company, and also seven built at the St. Charles Car Works.

An order for twenty-five engines has been placed by the Illinois Central, divided between the Rogers and Brooks Locomotive Works.

The Wabash are having 1,000 freight cars built, divided equally between the St. Charles Company and the Missouri Car & Foundry Company.

The Baltimore & Ohio have 3,000 cars under construction at the Michigan Peninsular Car Company, and 750 at the South Baltimore Car Works.

One thousand freight cars, equally divided between the Illinois Car & Equipment Company and the Michigan Peninsular Car Company, are under construction for the Northern Pacific.

The Baltimore & Ohio are having twenty-five Consolidation engines built, of which fifteen are being erected at the Baldwin Locomotive Works, and ten at the Pittsburg Locomotive Works.

The Philadelphia & Reading are having 1,000 cars built—200 by the Lebanon Manufacturing Company, 100 by the Middletown Car Works, 200 by the Jackson & Woodin Company, and 500 by the Union Car Company.

Mr. George S. Strong is still working on the balanced compound idea, and has secured another patent in connection with it. No one disputes the economy of a good compound, or that Mr. Strong's engine is balanced; but it's a case of the medicine being worse than the disease. Railroads are not apt to introduce inside cylinders and crank shafts to settle the balancing problem, even if a portion of it remains unsettled.

WHAT YOU WANT TO KNOW.

Questions and Answers.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(61) E. L. K., Pinetown, N. C., writes:

Will you kindly give me a good recipe for cleaning the gum off of the paint of locomotive driving wheels? A.—Kerosene oil is a good solvent for the purpose, and one widely used to remove hardened grease or gum from painted surfaces.

(62) C. W. K., Charleston, Ill., asks:

What part of the stroke would be the proper place to stand an eight-wheel engine, in order to key the brasses in the back end of main rod, and why? A.—When the pin is new there is no choice of position for keying the brasses in back end of main rod, but if worn, the keying should be done with the crank on the center, for the reason that the brasses are then keyed against the largest diameter of the pin.

(63) S. D. A., Wilkesbarre, Pa., asks:

What is the difference between the Whitworth system of screw threads and the United States standard? A.—In the Whitworth system of triangular threads, the angle formed by the two sides of the thread is 55 degrees, and the top and bottom of thread are each rounded over; the hight of the thread is about 63 per cent. of the pitch. The United States standard thread has an angle of 60 degrees between the sides, and the top and bottom are flattened an amount equal to one-eighth of the pitch.

(64) L. U. K., Hamilton, Ohio, asks:

What is a convenient method of estimating the weight of water in a pipe? A.—A very close approximation may be made by squaring the diameter of the pipe in inches; the product will be the number of pounds in a length of 36 inches of the pipe. Example: By calculation the volume of a 2-inch pipe 36 inches long is 113.09 cubic inches, which multiplied by 0.0361, the weight of a cubic inch of water at average temperature, equals 4.08 pounds. The square of diameter equals four = number of pounds nearly.

(65) F. F. H., Wellington, B. C., writes:

We are having trouble here with the brasses coming loose in the solid end side rods on one of our locomotives. What is the usual press fit for these brasses? We have been in the habit of pressing them in with a screw press, with a fit of about 5 tons, as near as we can figure it out. But the brasses come loose under the slightest heat. The brass is very soft and spongy. We wish to learn the usual Eastern practice with this style of side rod. A.—Schenectady Locomotive Works advise us that they use about 15 tons pressure for 4-inch pins, and from 20 to 25 tons for 7-inch pins, and that they do not know of any trouble from these brasses coming loose. Some roads do have difficulty, however, and considering that brass expands so much more than steel, it is not surprising. Our correspondent's brasses being spongy would tend to aggravate the difficulty.

(66) A. A. H., asks:

1. Don't you think it a bad practice to cool hot driving journals and crank pins with water? I claim it crystallizes journals and pins so treated, and I have noticed that where it is practiced drivers frequently drop off and pins are often broken. A.—1. Cooling with water is not considered good practice, except as a last resort, as it sometimes distorts bearing surfaces and makes them rough. It will not harden them materially or make them brittle, unless they are heated far beyond the safe point for running. It should not be responsible for wheels dropping off or pins breaking. 2. Please state what advantage is claimed for setting valves line and line, or without lead. A.—2. This all depends on circumstances. Some valve motions give an excessive lead when hooked up to working point, and in such cases they are often given a "blind" or "negative" lead in full stroke. With ordinary motions, however, a full stroke lead of 1-16 to 1/8 of an inch is sometimes given.

(67) N. B., New Albany, Ind., writes that piston valves on some engines cause the reverse lever to jump and jerk very badly, when rolling down hill shut-off, and asks how such valves are balanced, that they cause this disturbance in the reverse lever, and also if they are better than the balanced "D" slide valve. He also states that the men are having a great discussion on the subject of covering the steam ports with the piston valve in case the engine has to be run on one side. A.—The piston valve is supposed to be balanced under all conditions (which is one of the strong points claimed for it) for the reason that steam surrounds it in the case of internal admission, and pressures are only at the ends in the external admission type. It is not plain what connection there can be between the balance of such a valve and the effect noted on the reverse lever, since the engine is not working steam, as stated. The jerking may be caused by excessive friction due to tight rings on the valve, or if the latter works freely, overcoming its inertia may have the effect mentioned. There should be no more difficulty in covering the ports with a piston valve than with a plain slide. It may be blocked at each end, in the central position, or held there by a cramp on the valve stem.

(68) J. J. C., Brownwood, Texas, asks:

1. Has there been an estimate made of the amount of water wasted through a Crosby pop in popping off one minute, when a boiler has three gages of water? If so, how much? A.—1. There is no data obtainable for amount of discharge per minute of the pop you name. There is, however, a table in Kent's "Mechanical Engineer's Pocket Book," page 724, which gives quantity of steam discharged per hour by valves of the pop on Richardson type, for gage pressures from 30 to 200 pounds, inclusive, and for different diameters and lifts of valve. 2. Is there any mechanical reason why standard eight-wheel engines should break more side rods than ten-wheel or mogul engines? A.—2. The side rods of an eight-wheel engine are obliged to resist a greater proportion of the piston thrust than do those of the mogul or ten-wheeler, provided the boiler pressure and cylinder diameters are the same, for the reason that the pressure on the piston is transmitted equally to all the wheels. The side rods of the four-wheel connected engine will then resist one-half of that pressure, while those of the six-wheel connected engines will have to resist only one-third of it, and the first are therefore the weakest, if the rods are similar in all respects. Centrifugal force has a large influence in the failure of side rods, and since the square of the speed of crank pin in feet per second for the eight-wheel engine is about four times that for the mogul and ten-wheeler, assuming the engines to be in passenger and freight service, respectively, the centrifugal force will be greater in that ratio for the eight-wheel engine. Of course if the wheels are of the same diameter, and speed is the same in both cases, there will be no difference in the stresses produced by centrifugal force, assuming, at the same time, that the rods are of a like weight and length.

The first volume of "Easy Lessons in Mechanical Drawing and Machine Design" is completed by Part 12, which has just come to hand. This part deals with beams, trusses, levers, moment of force, and practical application of the principles is shown. One example shows a locomotive rocker arm, and the pressure on various parts is calculated and illustrated. Levers are thoroughly treated, and as this is an important factor in machine design, it should be appreciated. An index to the first volume also accompanies it. They also have the first volume bound and for sale at $7.50. This makes a valuable book and the clear and careful style of the author is appreciated by students. Published by the Arnold Publishing House, 16 Thomas street, New York.

The United States Metallic Packing Company are supplying 1,200 sets of babbitt rings for their packings on the Chinese Eastern Railway. They naturally feel quite proud of this, as their foreign work is fast becoming an important factor.

Lining Guides.

BY IRA A. MOORE.

Every apprentice who is learning his trade in a locomotive repair shop, and who is as anxious to advance as he should be, will embrace the first opportunity to line a set of guides. There are some things connected with this part of the work that can be learned only by practice, but we will endeavor to show as plainly as possible how the work should be done.

The purpose of the guides is to keep the piston in line with the center of cylinder. Hence to have them fulfill their purpose, they must be lined parallel with center of cylinder and with each other, and the right hight to bring center of hole in crosshead same hight as center of cylinder.

Suppose it is desired to line a set of four-bar guides, that a new back cylinder head has been put on, also a new guide yoke, and new guide blocks are necessary. have it just flush with the head. Then, with the dividers set to any convenient radius, scribe the arcs 1 and 2 across the line *a b*. Make a small center punch mark at the intersections of the line and arcs; then with these intersections as centers, and a little longer radius than arcs 1 and 2 were drawn with, draw arcs 3 and 4. Call their intersection point *g*. With a straight-edge draw the line *c d* through *g* and the center of stuffing box, when it will be at right angles to *a b*. Now draw *e f* through the center of stuffing box and parallel with *a b*. The width of the guides is 3 inches, and the distance between them 5½ inches. Hence the distance from *o* to *h* and *i*, Fig. 15, is 4¼ inches, which is equal to half the distance between the guides plus half the width of guide. Draw *h l* and *i m* parallel with *c d* and 4¼ inches on each side of it. The centers of the guide-block holes will lie in these lines, and a certain distance above the line *e f*, which

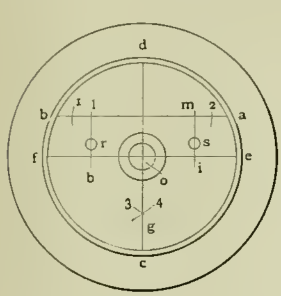


Fig. 15

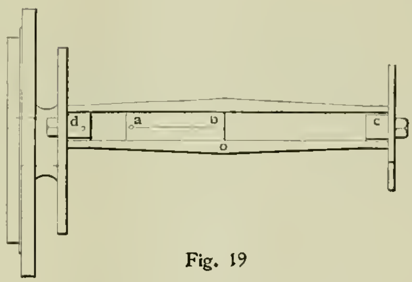


Fig. 19

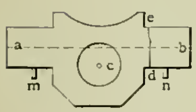


Fig. 16

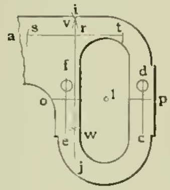


Fig. 17

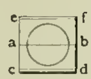


Fig. 18

Before putting the guides up they should be faced to a face-plate and at right angles to the edge. The ends should be planed slightly below the wearing surface. Steel guides can usually be made nearly straight by springing them under a press, after which they can be finished by filing, using a coarse file first, then finishing by draw-filing with a fine file. It is not necessary to use a scraper.

The guides are now ready to be put up, but as we are to have a new back cylinder head and new guide yoke, the holes for the guide-blocks must first be laid out and drilled. To lay out the holes in head, fasten it in place, then by means of a straight-edge across the frames scribe the line *a b*, Fig. 15, then draw *c d* at right angles to *a b*, and through the center *o* of stuffing box.

It is sometimes inconvenient to use a square for drawing line *c d*; hence we will use dividers and small straight-edge. Put a center in stuffing box, being careful to

distance we will now find. Referring to Fig. 16, which is an end view of the crosshead, it will be seen that the line *a b*, which passes through the centers of the wings, is above the center of the piston hole *c*. It is desired to have the center of the guide-block holes and the line *a b*, Fig. 16, lie in the same level; and since *o*, Fig. 15, and *c*, Fig. 16, must lie in the same straight line, if *h r* and *i s*, Fig. 15, be made equal to the distance between *c* and line *a b*, Fig. 16, then *r* and *s*, Fig. 15, are the centers of guide-block holes, which should be drilled not less than 1 5-32 inches.

To lay out the block-holes in guide yoke, put it in place on engine, then scribe the line *a b*, Fig. 17, parallel with top of frames. Run a line *l*, Fig. 17, through the center of cylinder, letting it extend a short distance back of guide yoke, then scribe *i j*, Fig. 17, at right angles to *a b*. To draw *i j* without using a square, make a small center-punch mark at *r* on the line *a b*, Fig. 17, directly over the inside of the vertical part of the yoke. Then with any convenient radius scribe the arcs *s* and *t*, using *r* as a center. With the intersections of the arcs and line as centers, and any radius, scribe the arcs *v* and *w*.

The line *i j* through the intersections of these arcs is at right angles to *a b*. Now draw the line *o p* parallel with *a b* and the same hight as center of cylinder. Draw *c d* and *e f* parallel with *i j* and 4¼ inches on each side of the line through the center of cylinder; the 4¼ inches being equal to half the width of crosshead plus half the width of the guide. The centers of the guide-block holes will be on these lines, and a distance above *o p* equal to the shortest distance between the line *a b* and center of piston-rod hole *c*, Fig. 16.

Drill these holes same size as those in cylinder head. The guides should be far enough apart to allow the crosshead 1-32 inch lateral motion.

After the holes are drilled in heads and yoke, put them in place again and fasten them permanently. The guide-blocks can now be turned up. They should be a tight fit in the holes. Put washers between the nuts on the back ones and the yoke. This will allow the length of the body of the shank to equal the thickness of guide yoke.

While the blocks are in the lathe a circle should be made on their outer ends, as shown in Fig. 18. This circle will be made use of in laying out the blocks for planing, which we will now proceed to do.

Plug the center up with lead, then get the center of circle on the end of block. Scribe the line *a b*, Fig. 18, through this center and at right angles to the sides of the block. The thickness of the wings of the crosshead, or the distance *d e*, Fig. 16, is 3 inches, and it is desired to have ¼-inch liner between blocks and guides. Hence the thickness of blocks will be ½ inch less than that of the wings of crosshead, or 2½ inches; or, in other words, the top of the block, after it is planed, will be at the line *e f*, Fig. 18, and the bottom at *c d*, which lines are parallel with *a b* and $\frac{2\frac{1}{2}}{2} = 1\frac{1}{4}$ inches above and below it. Lay out all the blocks in this way, then after having them planed to these lines, and also parallel with the center of the block, put them in the holes and lay out the bolt-holes, which can be done in the following manner:

Put the guides in place as shown in Fig. 19, using common C-clamps to hold them against the blocks, being careful to place them where they will not interfere with getting a scratch-awl into the bolt holes in guides. Now run a line through center of cylinder as for laying out guide-block holes, then set the edges of bottom guides parallel with this line, making the distance between the line and guides equal to half the distance between the side gibs on crosshead. Then the distance between the guides will be the diameter of the line more than the width of crosshead, or about 1-32 inch, which is the amount of side motion the crosshead should have. After getting the bottom guides in the proper position, take a scratch-awl and scribe lines on cylinder head and on guide yoke, along outside edge of outside guide and inside edge of inside guide. Then should they move, they can be easily put in place again by bringing them back to these lines. The top guides must be exactly above them, and since they are too far above the line through cylinder to use calipers in setting them, we will have to use some other plan. Get two parallel pieces of iron of the same dimensions and place one on engine frame, just back of cylinder head on each side of engine. They should be thick enough to hold a straight-edge above the top guides. Put a straight-edge on these parallels, and let one end extend out over the guides. Now put a square on the straight-edge, and let the blade touch the inside edge of the outer bottom guide. When the square is in this position, the inside edge of outside top guide should also touch the blade of the square. If it does not do so, it must be moved out or in until it is in the proper place. Now move the parallels and straight-edge to the back end of guides and set back end of outside top guide in the same way. If it is necessary to move it very much, it will throw the front end slightly out of line; hence it is well to try each end at least twice.

To set the inner top guide set calipers to the distance between the bottom guides, then set the top inside guide parallel with outside guide and same distance apart as bottom guides using the calipers to determine when they are this distance apart.

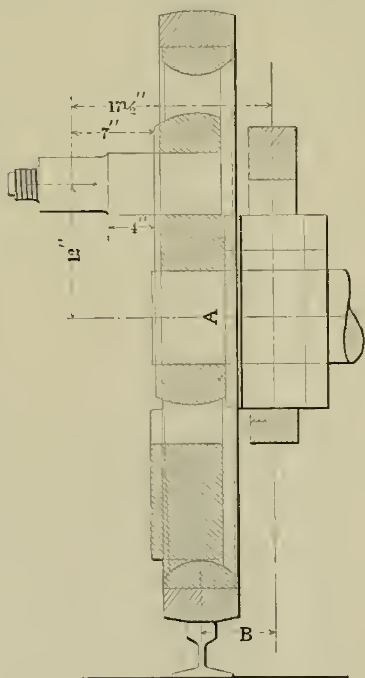
The guides now have the proper position, which should be marked on cylinder head and yoke same as bottom guides. Now the bolt holes in the blocks can be laid out with a scratch-awl through the holes in guides. Before moving the guides, make a line on both top and bottom of blocks along the edges of guides. These lines will show how much to plane off the edges of blocks to have them flush with the guides when the job is finished. Now take the guides down; take the blocks out and have them planed to these lines, also the holes drilled. They should be drilled about half-way through the block from each side.

Put the blocks in place again and set their tops parallel with a straight-edge placed across the frames and over the blocks. If the frame is lower than the blocks, put a parallel piece under the straight-edge on each side to raise it up; then caliper between block and straight-edge to determine when block is in the right position, or if a straight-edge cannot be used, a level may be substituted; but it should be of the kind commonly known as an adjustable level. Then should the engine not be setting exactly level, the level can be adjusted to the incline by putting it on top of the straight-edge across the frames and adjusting it to the incline of the straight-edge. Now put the level on top of one of the blocks, being careful not to turn it end for end, and it will show which way to turn the block to give it the right position. Don't forget to put the back cylinder head casing on (provided it is solid or not in two pieces) before going any further, otherwise it will be impossible to get it on without either cutting it in two or taking the guides down.

Loose bolts should be used for lining the guides, but should nearly fill the holes. Put pieces of pipe as long as the guides are thick between the heads of bolts and top of blocks. Now put up the bottom guides and put nuts on the bolts to hold them up to within ¼ inch of blocks (thickness of liners in this case), and stretch a line through center of cylinder.

Stresses in Crank Pins and Axles.

We are asked by a correspondent to explain as simply as possible what stresses are at work in crank pins and driving



Locomotive Engineering

axles to produce rupture, and how those parts are designed. To answer these questions we present an engraving of the main wheel and pin of a six-wheel connected engine, with a part of the axle, to illustrate the discussion with reference to them. This type of engine is chosen for the reason that engines with six or more coupled wheels have the main rod bearing outside of the side rods, and the pressure from the piston is therefore caused to act through a longer lever arm on such a pin than on a four-wheel connected road engine. This fact, it will be seen, introduces an element of weakness in the pin, that is not present in one having the main rod bearing next to the wheel, and it is not therefore in as favorable a condition to resist stresses as the latter.

The force on this pin we shall assume to be that due to a boiler pressure of 150 pounds on the piston of an 18 x 24 cylinder, for the reason that the figures are from an actual case we once dealt with, where the pin was too weak to transmit the pressure from the piston to the wheel. This pressure is equal to area of piston, times pressure, or,

$$\tfrac{1}{4}\, \pi\, d_2 \times 105 = 38{,}000 \text{ pounds,}$$

neglecting the angularity of the main rod. The pin being a beam fixed at one end and loaded at the other, the bending moment will be equal to $P \times L$, in which M = bending moment, P = pressure, and L = lever arm through which it acts. In this case $P = 38{,}000$ pounds, and $L = 7$ inches, to the hub of the wheel, which is the danger section of the pin. We then have, $M = 38{,}000 \times 7 = 266{,}000$ inch-pounds, provided no account is taken of the relief afforded by the side rods, which is theoretically equal to P divided among all pins, the load thus apportioned to the side rod pins giving a bending moment opposite in direction to that from the main rod, thus reducing M as found above, in which the reaction of the side rods was not considered.

As a practical matter of fact, however, a main pin designed with a view of assistance from the side rods, will stand up to its work satisfactorily until lost motion gets in its insidious work on the brasses, and then its finish begins, for the reason that it is subjected to stresses greater than it was designed to bear. This is coming to be understood by the builders at this time, as is shown by the more liberal dimensions of pins in the later engines.

The diameter of pin to resist the bending moment due to total piston pressure P, noted above, may be found by the equation:

$$D = \sqrt[3]{\frac{32 \times M}{S \times \pi}}$$

in which:

D = diameter,
M = bending moment,
S = unit fiber stress.

Placing 15,000 pounds per square inch as the limiting working fiber stress for steel, we have:

$$D = \sqrt[3]{\frac{32 \times 266000}{15000 \times 3.1416}} = 5.65 \text{ inches,}$$

which should be made 5.75 inches, and thus reduce the fiber stress to a still lower figure. This reduction is shown to be equal to the equation:

$$S = \frac{M \times c}{I}$$

where c = distance from neutral axis of pin to outermost fibers, or radius of section;

I = moment of inertia, which for cylindrical section is equal to $0.0491 \times D^4$.

Substituting values:

$$S = \frac{266000 \times 2.875}{0.0491 \times 5.75^4} = 14,200 \text{ pounds.}$$

In the case of weak pins referred to, investigation into the causes for the breakages revealed a wheel fit 4.75 inches diameter, or 1 inch smaller than that just found to withstand the same load. Calculation showed the weak pin to be subjected to a fiber stress of 25,200 pounds when resisting the total load. These pins represented the most favorable aspect of the situation, for other pins in the same class of engine were found stressed up to 28,300 pounds, on account of the inside collar being let into the wheel, and also having a large fillet behind the collar, neither one of which fitted the wheel, thus increasing the lever arm of the force and fatiguing the pin beyond endurance. A straight fit and increase of diameter cured the trouble.

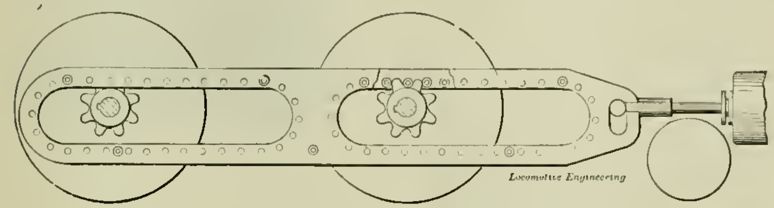
Axles are made of such a diameter as will insure against failure from a combination of twisting and bending stresses. There are several forces in action to cause rupture, one of which is that due to the piston thrust through the connecting rod; another is that from the torsional effort at the crank; another is that from the vertical load on the journal, and still another is from the lateral thrust of the flange against the rail on curves. The first and second of these, if provided for, it is believed, will give ample strength, and allow the others to be ignored. Of the forces thus neglected, that on the journal due to weight acts through such a short lever arm B as to give a very low fiber stress per square inch, while that due to flange thrust is of a very uncertain character, and though it is calculable for known conditions, no serious complications can ensue if it is neglected. In this case there is no flange.

The stresses are supposed to be concentrated at the center of the journal, but there is reason to believe that they are much nearer the wheel hub, because rupture occurs oftener at the hub than away from it. We shall assume the center of the journal as the origin of moments, because they are theoretically greater there than at the wheel. The force P being the same as before, the piston thrust acting through a lever arm 17.5 inches long, then the distance from center of pin to center of journal gives:

Bending moment M equals $38,000 \times 17.5 = 665,000$ inch-pounds.

The twisting moment $= P \times R$, in which R = radius of the crank, then:

Twisting moment M_t equals $38,000 \times 12 = 456,000$ inch-pounds. Combining the bending moment with the twisting moment, an approximate ideal bending moment is obtained from which to calculate the diameter of axle. Where M is greater than M_t the ideal bending moment equals $0.975\ M + 0.25\ M_t$. Substituting the proper values, we have: $0.975 \times 665,000 + 0.25 \times 456,000 = 762,375$ inch-pounds.



IMPROVED CONNECTING ROD.

Assuming a fiber stress of 18,000 pounds per square inch, which is safe for steel under the conditions, the diameter equals:

$$D = \sqrt[3]{\frac{32 \times 762375}{18000 \times 3.1416}} = 7.5 \text{ inches.}$$

It should be explained that there is a very remote possibility of the assumed stresses existing in the axle, for the reason that the worst conditions are taken in the calculations—that is, the total piston thrust is exerted on the axle, instead of that portion which would go there with theoretically perfect bearings on the pins; also the full turning effort at the crank is supposed to produce torsion; all of which positions are easy to conceive, and the above diameter therefore places the axle on the side of safety.

There is a well-defined and lively movement going on in railroad shops, having for its purpose a better means of compressing air for use in the many new devices for labor saving constantly coming to the front. It has come to be quite the thing to extend the piston rods of over-cylindered shop engines for this purpose, and attach a compressor to the cylinder, tandem fashion. The demand for air is an insatiable one, however, and if the shop engine cannot be transformed into a compressor by reason of insufficient energy, ways and means are found to accomplish the end by utilizing the cylinders of engines long supposed to have passed for good from the scene of action; but they are builded into air compressors, and well serve the purpose.

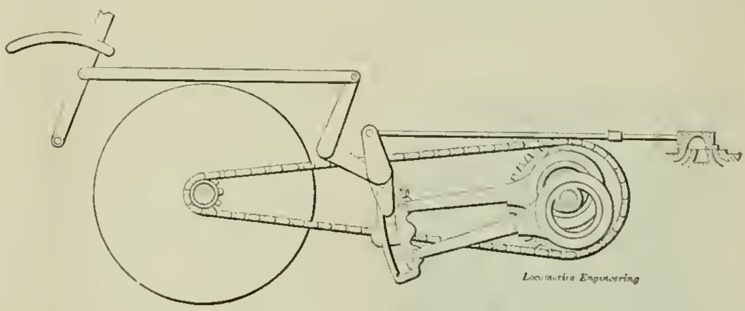
Improving the Locomotive.

Reciprocating parts of a locomotive come in for a good deal of attention, and the angularity of the connecting rod seems to bother a good many. This was evidently the case with the inventor of the device shown herewith, who had been told of the awful defects of the connecting rod, and started out to remedy them by doing away with the offending rod altogether.

The remedy is simplicity itself. A double plate frame is made as shown, and a sprocket attached to each driver. The sprocket is driven by the continuous rack formed by riveting thimbles between the plate, thirty-two being shown for each wheel.

This is simplicity with a vengeance, and we can imagine the action of such a device running sixty miles an hour.

The same inventor also tackles the valve motion and improves (?) it by driving the eccentrics from the rear axle by a bicycle chain. Words fail to express the utter foolishness of such a mechanical monstrosity, and we advise our inventive friend to confine his efforts to hand organs or threshing machines, and let the poor locomotive wend its own way to an early grave owing to its defects.



IMPROVED VALVE MOTION.

The Joseph Dixon Crucible Company have got out a new edition of their well-known pamphlet, "Graphite as a Lubricant." It is mostly a reprint of the 1897 edition, but has new matter and a striking cover. It is very interesting to any mechanic or engineer, and gives much information which is sure to be of value to anyone in charge of machinery. It is sent free on application.

Grand Trunk Shop Kinks.

A very ingenious way to machine the flanges of a dome saddle—that is, the surface bearing on the boiler shell—and also the caulking edge of the vertical flange, has been devised and is in successful operation at the Grand Trunk shops, Montreal. In fact, two separate and widely differing mechanical ideas are involved in reaching the results noted above. How this is done is clearly shown in the accompanying half tones.

Fig. 1 represents the saddle on a planer, while being treated for the boiler fit, by means of a tool bar having a radial movement transversely of the planer. This radial action is obtained by means of an auxiliary crossrail which is bolted to the housings, and which has at its center a swiveling clamp whose function is to hold the tool bar. It is plain that the distance from the center *A* of this clamp to the end of the cutting tool determines the radius of the curve cut by the tool, and its use in other directions is apparent. The lower end of the bar passes freely, but without shake, through a block that also swivels, but takes the place of the tool clamp on the regular saddle of the machine, and furnishes support to the tool bar. The tool is fed over the concave surface of the job by the feed screw through the lower crossrail.

The same dome saddle is shown on the face plate of a lathe, in Figs. 2 and 3, during the operation of facing up the caulking edge of a flange, which is seen to be concentric with the face trued up in Fig. 1. To face such a surface it is evident that the cutting tool must have a reciprocating movement equal to the distance from the highest to the lowest point on the surface to be trued. Fig. 2 shows the operating side of the lathe and the crank mechanism to obtain the back and forth tool movement, and Fig. 3 shows the rear side with the system of gearing to drive the crank and tool. These shop kinks which give proof of a resourceful acquaintance with mechanical principles, were evolved and put into practice by Mr. John Millington, foreman of the Montreal machine shop. The Grand Trunk has long been noted for clever schemes in labor saving devices and special tools for handling work, and the latest efforts in that line do not appear to be materially behind the former ones in reaching results.

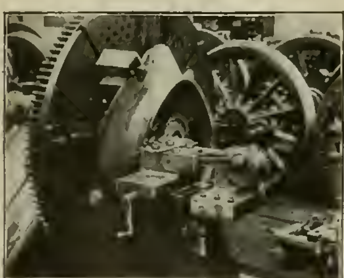


Fig. 2. FACING EDGES OF FLANGE.

Staybolts.

Staybolts received a little attention at the Niagara Falls meeting of the American Society of Mechanical Engineers, when Mr. F. J. Cole, of Paterson, N. J., presented a paper on "Bending Tests of Staybolts." Mr. Cole has made a bending machine to ascertain the life of staybolts being constantly under bending strain, but, according to Mr. Gus Henning and other authorities, the machine does not represent actual conditions, and therefore the results are not as exhaustive as they might have been.

It is admitted that staybolts are injured less by direct steam pressure than by the bending action of the sheets due to various causes, and the aim is to decrease these injurious actions as much as possible, and to find material which will best stand such bending as is unavoidable.

Mr. Henning thought much of the difficulty came from lack of care in putting in staybolts, especially where machines were used, and cited instances where the thread had not caught in the further sheet at the proper time, but had been given a full turn before catching the thread, springing the sheets the amount of the pitch of thread. This, of course, imposes an initial strain on the sheets in the shape of a bulge, and adds to the probability of failure of the staybolt. While it may be an exceptional case to have such an initial strain, it is evident there are too many different strains before the steam gets to work.

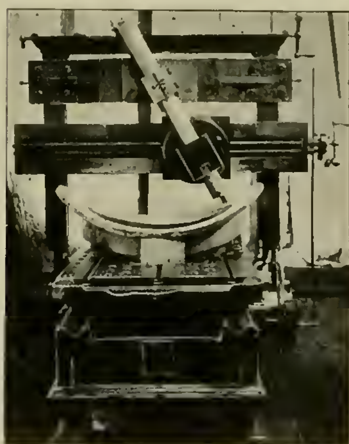


Fig. 1. PLANING DOME SADDLE.

Mr. Henning suggested that if distance pieces could be clamped between the sheets while they were being tapped and the staybolts were being screwed in place, all this would be avoided. Prof. Sweet mentioned his idea of a flexible staybolt, as appeared in our June issue, and it was admitted that it would stand more bending than the solid bolt.

It was pretty generally conceded that it was fully as necessary to use staybolt iron that would stand the bending strains as to have an iron that was especially strong in tension alone. The effect of cold riveting of staybolts was also discussed, and instances cited where this had produced crystallization for a distance of over an inch or through the sheet.

This kind of iron is evidently unsuited for staybolts, and this is one of the important features to be considered.

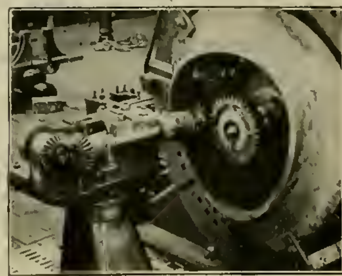


Fig. 3. HOW THE TOOL IS DRIVEN.

Care of Belts.

A railroad shop that gives anything more than passing consideration to machine belting is one of the rarities that is worthy of mention. It is quite the thing for private concerns that are run on a business basis to look closely after the condition of belts, a man being assigned to that duty exclusively, because it has been found to pay. Some railroad shops are following in the same line; among them is the Baltimore & Ohio, which at the Mount Clare shops has a well-defined system of caring for the belts on the whole road. The men engaged in the work are up in their business, and make use of their knowledge to the profit of the company, by splicing up pieces that would otherwise be of no use, into belts that can be utilized. In addition to this, there is a decidedly longer period of usefulness guaranteed to a belt, when it is "taken up" or spliced by a man that knows something about the tension the belt will put up with before making a protest, than when leaving the job to be done by the man running the tool, who is more than likely to make it too tight and have another break on his hands in a short time, with consequent lost time due to the stoppage. The belt gang does away with all such trials, besides keeping many a foot of good belting out of the scrap.

A writer suggests the use of illuminated colored balls for comparison with hot steel in hardening. A good idea, if it can be carried out; but if the hardener becomes "fire blind" while watching his piece, as so many do, he would wrongly interpret the color of both guide and piece. A variation in the degree of sunlight would also be likely to throw the hardener off his balance; but this could be controlled by darkening the room. The suggestion is at least worthy of a trial.—*Sparks.*

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

New York, New Haven & Hartford Air Brake Instruction Car.

We show in this issue the plan and interior arrangement of the instruction car which has just been built at the New Haven shops of the New York, New Haven & Hartford Railroad.

The interior of the car is divided into three compartments—an office, an instruction room and a boiler room. The finish in the office is plain, the idea being to secure the greatest accommodations and comfort in the smallest space.

The instruction room has been planned so as to have the free floor space at one end, which will be used for the instruction. The other end contains twenty freight-car brakes, sectional parts of governors, injectors, lubricators and slack adjusters. The passenger brakes, consisting of engine, tender and passenger car apparatus, are on the side of the car, while on the side deck is the signal apparatus for ten cars. All of this can be operated from the instructor's seat, next to the main reservoir, where is also located a revolving table, containing sectional parts of the several valves. This portion of the room will seat twelve to fifteen men, and from their seats they can see the operation of any part of the apparatus.

All train pipes are painted blue, main reservoir red, auxiliary reservoirs brown, brake cylinders yellow, and signal apparatus green.

The boiler room is entirely shut off from the instruction room, although the instructor can see the gages on the boiler through a window in the partition. The principal reason in separating these rooms was to prevent the noise of the air-brake pump from disturbing the class, and it has been found to be a very satisfactory arrangement. The boiler is directly over the truck center, to one side, while opposite are the water tank and coal box. In the upper deck are several cylindrical tanks which furnish water to the washstands and to the closet.

The end of the car from the boiler room can be thrown entirely open by means of a double door, to fill the coal box or to obtain ventilation in warm weather.

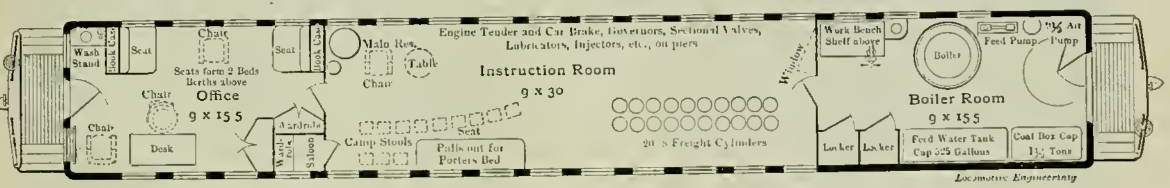
The piping for the twenty sets of air brakes, the air signals, and all other piping, where possible, has been placed underneath the floor. Access is had to this by means of floor plates over valves and cocks by which any part of the piping can be shut off or disconnected.

The steam-heat piping has been so arranged that the car can either be heated from a stationary plant or from a locomotive, and so that the main reservoir can be charged from a compressor or from a locomotive.

The exterior of the car presents a very pleasing appearance and has been painted the standard Quaker green of the New Haven road, being nicely striped.

The trucks are six-wheel, platforms combination with National couplers, and equipped with trap doors over the side gates.

The car is 61 feet 5 inches long, 9 feet 6 inches wide over sills, and weighs 120,000 pounds.



PLAN OF THE NEW YORK, NEW HAVEN & HARTFORD NEW AIR BRAKE INSTRUCTION CAR.

The car will be in charge of Mr. J. L. Andrews, air-brake inspector, under whose supervision the car was built. It will be used at present for air-brake instruction almost entirely; but later on it is expected to lead into other channels.

Suggestion to Writers.

Occasionally we receive meritorious letters for publication from persons who desire their real name withheld and a fictitious name used. A person who thus writes over a nom de plume robs himself of credit justly due him, and therefore does wrong by injuring himself. This should not be, for anyone who can write an interesting or instructive article has really no reason for evading the authorship of it.

We are glad to note that nom de plume writing is confined to new or young writers who perhaps underrate and doubt their true ability, and is not practiced by older and more experienced writers. As we endeavor to make LOCOMOTIVE ENGINEERING free and fair, we trust that hereafter nom de plumes will be abandoned and real names be given for publication.

Notice to Correspondents.

We would again urge that all contributors to the air-brake department send in their matter no later than the 12th of the month, as this department is one of the first that goes to press. Correspondence arriving later is necessarily held over until the following month. Read your paper as early as possible, and if you wish to make any comment, write us immediately.

Piping to Air Gages.

There are certain details in air-brake practice that pay to be observed. One of these is the piping to the air gage. At the Nashville convention of the Air-Brake Association, Mr. H. W. Decker, now deceased, reported that coupling up the gage with rigid iron pipe, not accurately bent to fit, would distort the gage tubes sufficient to make a difference of 12 or 15 pounds in the register. Since attention has been drawn to this irregularity, we can easily see how it could happen. If iron pipes are used, they should be accurately bent, and the collar on the pipe should fit squarely against the face of the nipple on the gage without any strain on the pipe when the coupling nut is screwed up tight. Perhaps the better way to avoid the difficulty would be to use copper pipe, although it is a little more expensive. We would know then that the gage was registering accurately.

The neglected condition of air brakes on private-line cars is strikingly shown by the systematic record kept by the Nashville, Chattanooga & St. Louis Railroad of air-braked cars passing over that line. During the month of June, 1898, there were 2,853 air-braked cars forwarded from the Nashville, Tenn., freight yards. Of this number, but twenty-one brakes were cut out. Eleven were on private-line cars, and ten were on cars belonging to railroad companies. When it is considered that the number of cars in the United States owned by the railroads far exceeds those owned by private-car lines, we shall see that the latter are not nearly doing their share of work towards keeping air brakes in operative condition.

CORRESPONDENCE.

Coupling Up Broken Air Brake Trains.

The discussion of the best method of using the air brake when coupling up broken-in-two air-braked trains, begun by Mr. Dan O'Brien in our June number, has doubtless been productive of much good to many readers, for logical discussions are always interesting and instructive, inasmuch as they encourage thought and study and impel investigations that otherwise might never be made.

A number of communications on the above subject arrived just too late for insertion in our July number, and we therefore append them herewith.

George E. Houtz, Tacoma, Wash., sustains the opinion of Mr. O'Brien, giving similar reasons therefor, and urges "that it is the duty of the man handling the stop-cocks to properly open them so as to avoid making emergency applications."

J. Ernest Ingling, Erie Railroad, Jersey City, N. J., also upholds Mr. O'Brien's side of the argument, giving as his reasons therefor practically the same as advanced by Mr. O'Brien.

Mr. J. H. Low, locomotive foreman, Canadian Pacific Railway, North Bend, B. C., disagrees with Mr. O'Brien, and writes:

"Let it be granted that by making a 5-pound reduction with the engineer's valve, before angle-cock is opened, that we will only get a full service application (which I doubt), or an equalized pressure of 50 pounds in auxiliary and brake cylinder. This means that we have to raise the auxiliary pressure 20 pounds to fully recharge.

"On the other hand, suppose we do not make this 5-pound reduction before angle-cock is opened, but allow the brakeman to do his worst. The result will be an emergency application. We now have an equalized pressure of 60 pounds in auxiliary and brake cylinder, which means that we have to raise the auxiliary pressure 10 pounds to fully recharge, or only half the quantity of air required where the service application was the result of opening the angle-cock.

"Let us now consider the train pipe pressure. In the first case, where a 5-pound service application was made, we would have 65 pounds to go back and assist in charging the empty train pipe and auxiliaries of the rear cars.

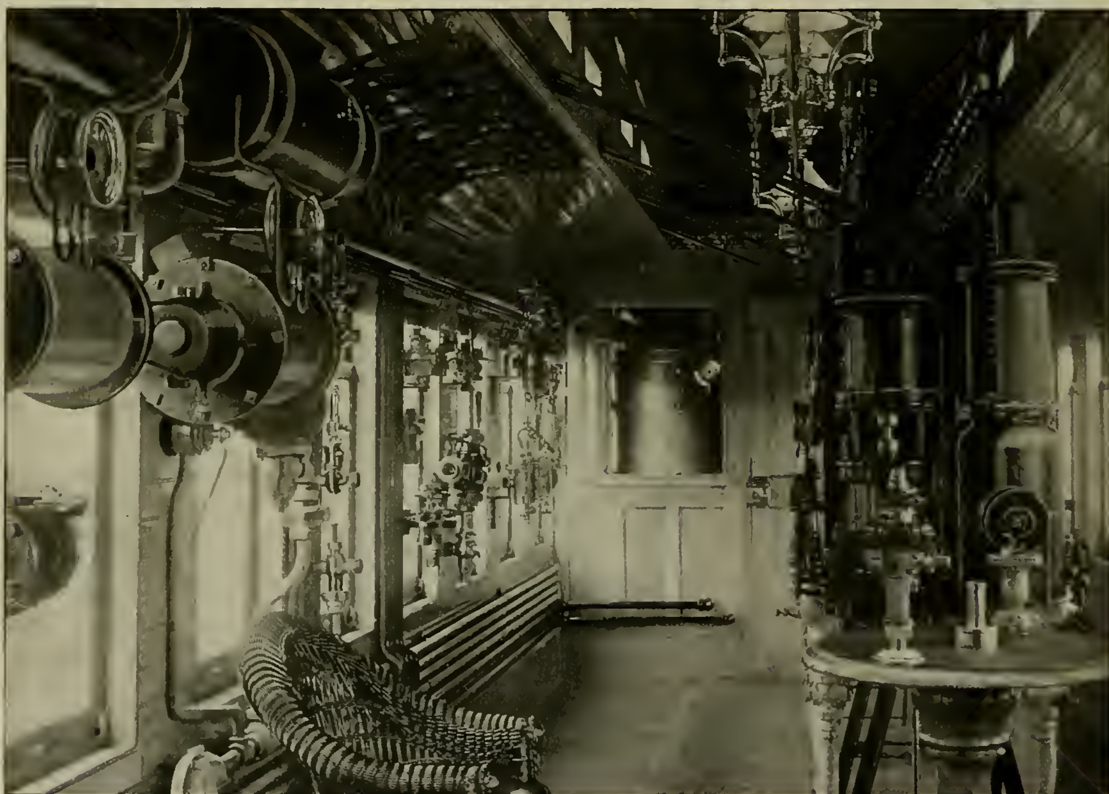
"In the second case, where the head section went into emergency, we would have about 40 pounds to go back to rear section. This shows a loss of 25 pounds in train pipe pressure of head section; but the train pipe, being of much less volume than the auxiliaries, will require less air to recharge it than would be required to raise the auxiliaries the additional 10 pounds."

Walter P. Garaghey, Baltimore, Md., takes the opposite side to Mr. O'Brien, and writes:

"Our practice is to have a moderate pressure on head portion of train, and when brakes are used for the last time in coupling on to cars to be added to train, if brakes set at moment coupling is made, let them remain set, leaving engineer's valve blanked; and when full pressure is indicated in main reservoir, throw such pressure into train pipe, releasing brakes, and quickly charging cars picked up. When brakes are not set at moment coupling is made, let brakes remain off and engineer's valve blanked, until all couplings and communications are known to be made, then throw full pressure into train pipe. In this way air flowing out of pipes back into empty cars will set the brakes anyway, and be more of a benefit than wasting it into atmosphere to set them."

W. W. White, air-brake instructor, Michigan Central Railway, Jackson, Mich., disagrees with Mr. O'Brien, and writes as follows:

"Suppose J. H. B. to have a train of twenty cars, all equipped with quick-acting triple valves, train line and auxiliaries equalized at 70 pounds. While running, ten cars break off, and when coupling up



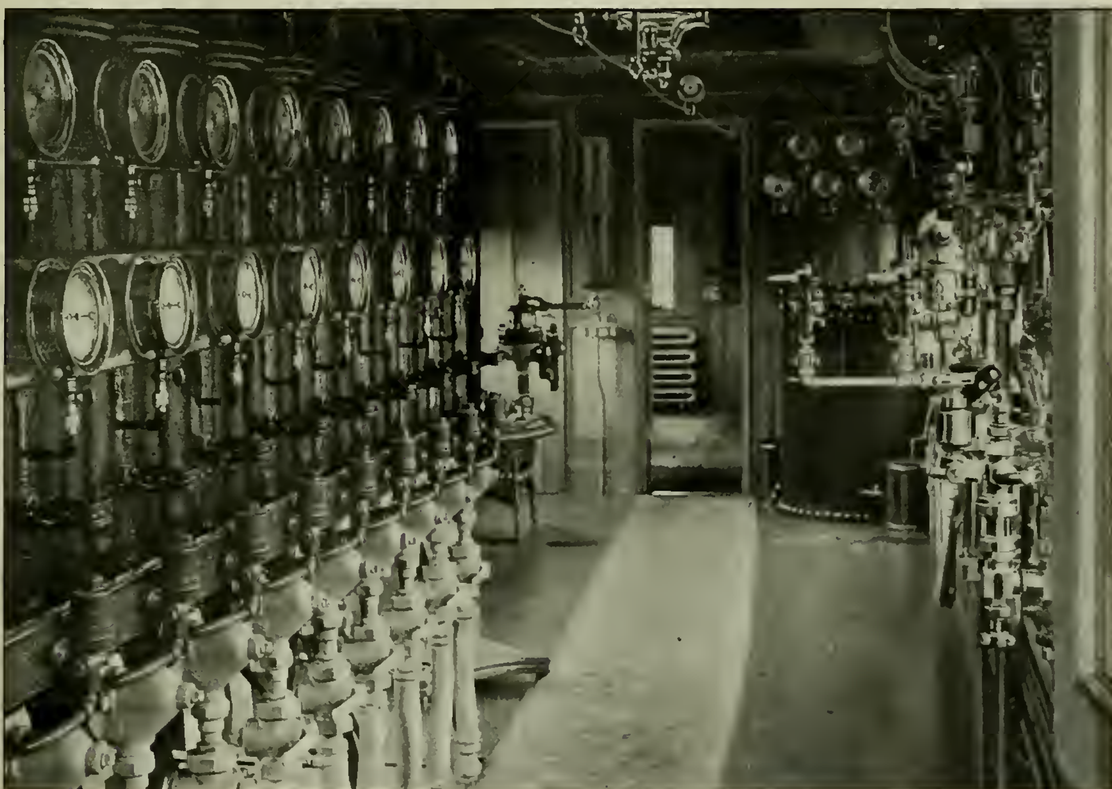
AN INTERIOR VIEW OF THE N. Y., N. H. & H. R. R. INSTRUCTION CAR LOOKING TOWARD THE BOILER ROOM train again he makes a reduction on head section of 5 pounds at brake valve. Now, if trainman opens angle-cock suddenly, triple valves are thrown into emergency, auxiliaries and brake cylinders equalizing at 55 pounds or more.

"Suppose again, that J. H. B. makes no reduction. When trainman opens angle-cock suddenly, triples are thrown into emergency, and auxiliaries and brake cylinders equalize at 60 pounds, resulting in an equal waste of air in each case.

"Moving triple piston out against graduating stem with a 5-pound service reduction, does not prevent it compressing graduating spring when a sudden reduction is made; and as pressure in brake cylinder would be low with a 5-pound reduction, it would not hold check valve down against train pipe pressure. With an exceedingly long piston travel, cylinder pressure would be correspondingly lower, resulting in a higher increase when triple moves to emergency. Therefore no saving is made with any kind of a reduction at brake valve.

"To practice a saving in such cases, trainmen should be instructed to open angle-cock a very little at first, allowing train pipe pressure to pass into rear section slowly and equalize before opening it wide. This in a great many cases saves time as well as air. Saving time when broken in two is often more important than saving air."

The proof that a quick-action application is not impossible after a 5-pound train pipe reduction has been made, and the triple piston has moved out against the graduating stem, relieves the recommendation to reduce 5 pounds before coupling up of considerable of its strength, and quite clearly decides the question in favor of those opposing the plan. It is also made plain by both sides of the argument that the brakeman, by proper or improper opening of the stop-cock, has more to do with the saving of air and time, in case of breaking in two, than the engineer.



INTERIOR VIEW OF THE N. Y., N. H. & H. AIR BRAKE INSTRUCTION CAR LOOKING TOWARD OFFICE AND SHOWING LIBERAL USE OF GAGES ON CYLINDERS AND AUXILIARIES.

A Good Suggestion.

Editors:

On many of our fast trains a class of engines known as the "Mother Hubbard" (Wooten) type is used, on which, while the train is in motion, the engineer is the sole occupant of the cab, the fireman's position being at the rear of the boiler and next to the tender.

As instantaneous action is of the utmost importance to prevent disaster sometimes, would it not be a wise plan to provide a conductor's valve within easy reach of the fireman for him to use in case the engineer, from any cause, should fail to apply his brake at the proper place?

I notice that many of the engines of this class are so constructed that a fireman could not get to the engineer's valve to use it until much valuable time had been lost.

J. P. KELLY.

Pittsfield, Mass.

Important "Don'ts."

Editors:

I beg to submit the following few "dont's" to readers of LOCOMOTIVE ENGINEERING generally, and particularly to those having to do with the piping of air-brake cars.

In air piping engines or cars, don't put the red lead inside the elbow, tee or fitting. The result of so doing is that the lead being forced inward by the introduction of the pipe into the fitting, eventually finds its way to the conical strainer in the triple valve, and a partially or wholly stopped up strainer is the logical outcome.

Don't put up the piping before being blown out with steam. An inspection of the interior of the pipes will often reveal scale or sand held in place by a gummy substance, and which a current of air blown through the pipes, or hammering, fails to dislodge. The constant jar of the pipes in service gradually loosens the foreign substances. Many brake valves, triples, conductors' valves and air-signal valves have given trouble from this lack of precaution in cleaning the pipes.

Don't use ells when it is practical to bend the pipes. Every joint made is a constant invitation for train line leakage, as well as interfering with the proper action of the brakes, particularly on long trains.

Don't try to screw angle and cut-out cocks on pipes with the aid of several feet of pipe to increase the leverage of your wrench. The cocks are threaded about right, and if the cock will not go on sufficiently with a reasonable wrench leverage, examine your dies and see if they are in suitable condition to cut the pipe thread the right size.

Don't think that pipe clamps are required only to keep the pipes from falling off the car. Every clamp should hold the pipe rigidly to prevent vibration and shifting, and incidentally to prevent the joints from springing a leak.

Don't apply the retaining valve pipe simply as an ornament, or merely to carry out instructions. Tight joints are just as important in this pipe as any of the others.

Don't think that the only requirement in locating angle cocks is to have them on the end of the tender or car. The hose are of such length that if the center of the angle-cock key is 13 inches from the center line of car, 13 inches from the face of plain draw-bar or the inner face of the vertical plane hook, and 33 inches from the rails, or no great variation therefrom, no trouble will be experienced in obtaining desired results.

Don't neglect to observe these points.

S. J. KIDDER.

Chicago, Ill.

Answer to Air Signal "Kink."

Following is the answer to the air-signal problem given in last month's number:

"The engine that left baggage car on siding was carrying a very high pressure in signal line on account of pressure-reducing valve being set too high. The engine that picked up the car was carrying standard pressure (40 pounds) when hose was coupled. Rear stop-cock was turned first. This allowed the high pressure in the rear car to equalize throughout the train, instead of making a reduction and blowing whistle."

Mr. C. L. Silver, Richmond, Va., sent a correct solution to the problem.

Mr. C. J. Wilson, superintendent of the Northern Pacific Railway at Jamestown, N. D., has fitted up an air-brake instruction room for the use of the employés at that place. The room is 18 x 24 x 12 feet. An air-brake club was formed last December, and interesting and instructive meetings are regularly held.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(72) G. N., Buffalo, N. Y., asks:

Will you please let me know what effect a leaking graduating valve in triple will have after break has been applied? A.—It will generally release the brake sooner or later, but under some conditions it will not. See editorial comment on "A Leaky Graduating Valve," page 99, February, 1898, number.

(73) P. M., Lawrence, Mass., asks:

Where can I get full and reliable explanation of the Westinghouse air-brake system? A.—Ask your master mechanic to apply to the Westinghouse Air-Brake Company for gratuitous copies of instruction books, and send us 25 cents for "Progressive Form of Questions and Answers on the Air Brake."

(74) J. H. G., Houston, Texas, writes:

If main reservoir was disabled so it could not be used, could I use the brakes, and how? A.—There would be no practical way. However, the pump discharge pipe and main reservoir pipe to brake valve might, in an emergency, be coupled together with a rubber hose, but this scheme would send hot air, dirty oil and sediment back into the brake valve and train system, and would ordinarily do more harm than good, to say nothing of uncertainty and trouble in releasing brakes.

INTERIOR VIEW OF THE N. Y., N. H. & H. INSTRUCTION CAR BRAKE VALVES, TANDEM SECTIONAL TRIPLE VALVE, GAGES, ETC., AND LOOKING TOWARD OFFICE.

(75) W. C. G., Chester, Pa., writes:

I understand that the recess cut in the seat of the D-8 rotary valve, between ports *e* and *f*, was to prevent establishing a lap position between full release and running position. Will you please inform us why this is omitted in the D-5 and E-6 valves? A.—There is no lap position between the full release and running positions in these valves as there was in the D-8. The feed through the full release or direct passage is not cut off until that through the feed valve attachment or running position is nearly half open.

(76) W. P. G., Chester, Pa., asks:

Why is it that in testing cars in some yards they test the brakes with 90 pounds pressure, while on the road 70 pounds only are used? A.—The piston travel is longer on a car when running than when standing still. If set at 7 inches standing travel, the piston will be 8 or more when making a stop. By testing with 90 in yards, a nearer approach to the conditions of the true or running travel is had; hence the 90 pounds test. See slack adjuster paper in Air-Brake Association (1898) Proceedings.

(77) P. M., Lawrence, Mass., writes:

In February number H. I. G asks: "Why is the piston 53 in the F-8 governor made wider than the one used in the old-style D-9?" Please explain the meaning of these letters and numbers, and where they are taken from. A.—In the catalogs from which store-room keepers order supply parts for the air-brake system, a page or plate is given the pump, triple valve, brake valve, governor, etc. The first catalog was numbered "A," and the last "F." The figures 8, 9, 10, etc., designate the pump, governor, etc. The figure 53 marks the particular part of the pump, governor, etc. Thus piston 53, F-8 governor, means the piston 53 in plate 8, catalog F.

(78) T. B. O'G., Bloomington, Ill., asks:

Why is the feed port in a freight triple valve, quick action, smaller than that of a passenger valve? A.—Longer freight trains than passenger trains are hauled, and air sent back into the train pipe from the main reservoir must first move all the triple pistons to release position before the charging of auxiliaries begins. On passenger trains there are but few triples to feed off the train pipe, while on freight trains there are many. If the freight triple groove was larger, the head cars would absorb all the pressure and leave none to go back and release the rear brakes. Passenger trains, being shorter, can have triples with larger feed grooves without having this trouble.

(79) E. L. K., Pinetown, N. C., writes:

We have a new 8-inch Westinghouse air pump on one of our locomotives, with a Mason governor. When the pump was first put on, it worked all right, but in a few weeks it would jar the whole engine while making its upward stroke. In closing off steam valve, just so pump would keep up required pressure, it would hardly ever jar any; and when it did, would be very light. We work straight air, and carry a pressure of 40 pounds. A.—The governor is evidently not sensitive enough. When you regulate the pump by the throttle, the pressure is kept below that pressure which controls the governor, and really prevents it from acting as a governor. Your trouble would probably be lessened by easing off the differential piston.

(80) A. R. N., Cleveland, O., writes:

The Westinghouse air-brake instruction book says that to get quick action you must draw off 20 pounds. I know that much less will do the work, but just how much I don't know. Will you inform me what is the least reduction that will get quick action? A.—The instruction book wants to make sure that quick action will be gotten when it is gone after. It is not the amount of pressure drawn off that produces quick action. One or two pounds quickly drawn off will sometimes cause quick action, but 15 or 20 pounds slowly drawn off will not. In attempting a quick-action application, it is more important that the application is surely obtained than it is to save air. Hence, to apply brakes quick action, put brake valve

BOILER ROOM OF THE N. Y., N. H. & H. NEW AIR BRAKE INSTRUCTION CAR.

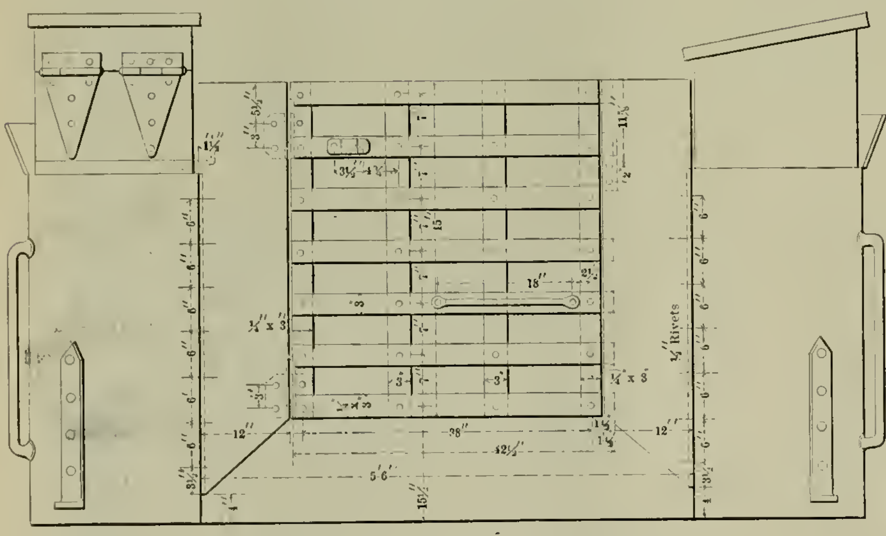
handle in emergency position, and leave it there until stop is made.

(81) J. H. G., Houston, Texas, writes: If you have 70 and 90 pounds train line and main reservoir pressures respectively on your gage, train all cut in, angle cocks all open, and you applied your brakes in service, and they would not hold, where would you look for the trouble? A.—(a) The leather packings in the brake cylinders might be in bad condition, and allow the brakes to leak off; (b) the piston travel might not be adjusted, rendering brakes weak; (c) brake shoes might be so hard as to have little holding power; (d) brakes might not have been applied far enough back from where stop was desired; (e) a few air brakes might have been expected to hold a train in which were too many non-air cars; (f) while train line pointer showed 70 pounds, yet the auxiliary reservoirs may not have been fully charged; (g) rotary valve might leak off brakes.

Keegan's Tender Coal Gate.

The tender gate here shown is a safety device got out by Master Mechanic Keegan, of the Grand Rapids & Indiana, to take the place of the awkward coal boards usually employed to keep the coal on the tender from working on to the footboard. In one instance the gate saved the lives of the enginemen by preventing the coal from flying forward and pinning them to the boiler head in a collision.

It is a very strong and serviceable gate, easily operated and never in the way. It opens inward and can be secured to the side of the tender when not in use.



KEEGAN'S TENDER COAL GATE.

Testing Locomotive Staybolts.

The paper on "Bending Tests of Locomotive Staybolts," by Mr. Francis J. Cole, presented to the American Society of Mechanical Engineers at Niagara Falls, was an interesting contribution to the literature of the subject, because of the fact that the investigations were pursued on the premise that the tensile stresses on staybolts are insignificant as compared with those produced by repeated bending due to the movement of the firebox by contraction and expansion.

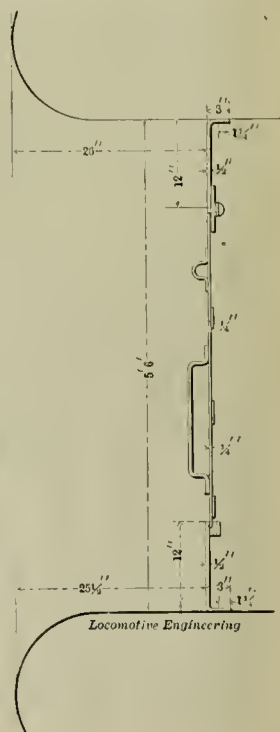
In the effort to duplicate actual service stresses on the samples of iron under test, a machine was devised which would rigidly hold one end of the specimen while the free end was made to move in a circle of one-sixteenth inch radius, which it was assumed would closely approach the bending conditions of bolts in a firebox. At the same time the bolt was placed under a tensile stress by a spring giving a constant pressure of 2,400 pounds, which was to represent an area of 16 square inches under 150 pounds boiler pressure.

Among the findings resulting from the test, it was stated that "cutting off the threads and reducing the size of the middle of the specimen does not, in these tests, indicate a sufficient degree of improvement in prolonging the life of the staybolt to warrant the extra expense. It appears that after a bolt is reduced and turned down a sufficient amount to equalize the strain, and to distribute it over a considerable portion of its free length, the stress produced by the pressure of the spring runs up to such an extent, per square inch of section, that the combination of bending and extension stresses exercises a marked influence in shortening the life of the bolt."

In view of the general practice of reducing the diameter of staybolts between the fits in the sheets, the result of the test in this regard may excite renewed attention to the necessity of its continuance, or cause further inquiry to be made, to either refute or confirm the finding noted above, as there is a well-ground belief among many locomotive men that reducing a staybolt at the center has its advantages.

Peculiar Hammer Foundations.

An interesting feature of the "blacksmith shop upstairs" shown in our July issue was overlooked in the description.



The anvils and drop hammers do not rest on the floor of the building, as this would be hard on the floors and walls; so a heavy timber is run from the ground to the forge room, through the floors but not fastened to them.

This makes a solid foundation, and practically places the heavy weights and shocks on the ground. It is a very neat scheme and can be followed to advantage.

The *Railway Record* is credited, in one of our most valued exchanges, with a description of the Erie's practice of lining driving-wheel hubs at the Susquehanna shops. The story is well told, because it is in *our* happiest vein. "Who steals me purse steals trash," but he that filches the work of our gifted pen gets the best of it.

Car Department.

CONDUCTED BY O. H. REYNOLDS.

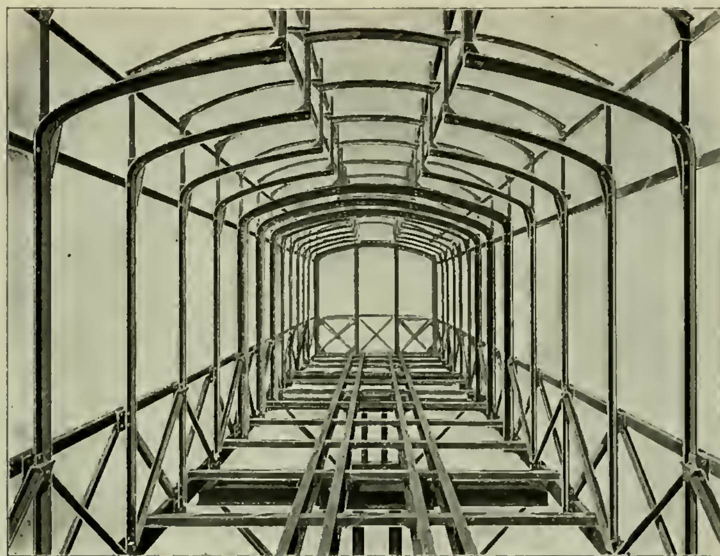
The Kinetic Motor.

The Jackson & Sharp Company have just completed, at their car works, a Dodge motor for the Detroit & River St. Clair Railway Company. This machine differs from other motor cars in the very important particular of seating capacity, which is brought about by locating the driving mechanism beneath the sills, thus being able to utilize all of the floor space for seats—in this case for sixty people—and making a shorter car for a given number of passengers.

The power consists of the Dodge stored steam system, in which water is heated in stationary boilers at a central station and passed to storage boilers or reservoirs which are carried under the car. No steam is generated in the central station boilers, the water being only heated to a temperature of about 380 degrees Fahr., and let into the motor boiler or reservoir up to a level which leaves a proper steam space. A small firebox is used in connection with these reservoirs, into which is placed a charge of anthracite coal heated to incandescence, the heat from which will maintain the required pressure between terminals by making up for losses of condensation and radiation.

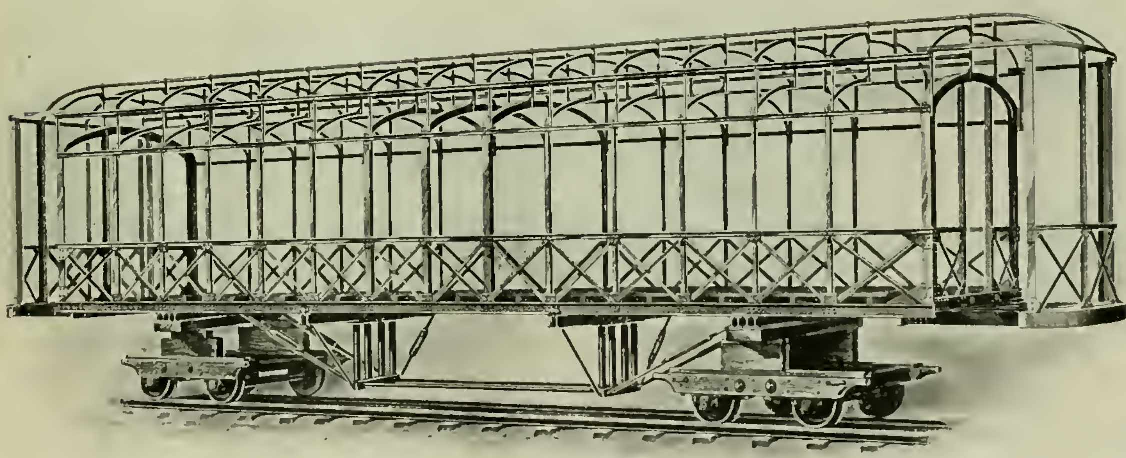
This pressure is used in a pair of 8 x 12-inch cylinders on a four-wheeled truck at each end, having drivers 38 inches in diameter, and capable of a speed of 35 miles an hour; each truck being an independent link-motion engine.

The motor is handled from the platforms. The exhaust is piped to the air condenser located on top of the car at each side of the clear story; the object of the condenser being to remove the back pressure from the cylinders and not allow exhaust steam to escape.



STEEL FRAMING OF CAR.

In the framing of the body of this car, which is the subject of our illustration, a long stride in advance of wooden practice is to be noted. Every member is of steel, made up of standard commercial shapes. The sills are channels, while the corner posts are made of angles, and continuous, forming the end plate, the intermediate posts performing the double function of post and carlin. The plate, belt rail and braces are also of angles, securely riveted. The body bolsters are composed of four I-beams riveted together. The platforms are made up of the same material, with channels passing under the car sills with posts and braces the same as in the body.



STEEL-FRAMED CAR BY JACKSON & SHARP CO.

An extraordinary depth of truss rods is shown, which is accounted for by the necessity of space for the reservoirs and heater, these being carried between the cross-tie members. In length the car is 45 feet over all, and of the usual width of a vestibuled passenger coach, which it resembles in finish, with the exception of the pilot at each end and an apron extending full length of the car below the sills, which covers the engines and boilers. This is the first passenger coach body coming to our notice in which the framing is made up of steel shapes, the strength and lightness of which are well shown in the half-tones, and will no doubt leave a favorable impression on those wavering between wood and steel for car framing. It is certainly a long step in advance in passenger car construction, and also shows the facility with which the Jackson & Sharp Company can adapt their plant to all requirements of car work.

PULLMAN APARTMENT SLEEPER.

PULLMAN DRAWING-ROOM CAR.

Side Bearings.

There has long been a division among car men as to the utility of side bearings, and the contention is apparently no nearer satisfactory adjustment now than it was at the beginning, when heavy loads began to worry weak bolsters, and insist on being carried at three points, a condition that obtains on a large percentage of freight cars, and differing in amount and degree dependent on the stiffness of the bolsters on body and truck.

It is urged by their friends that side bearings correctly designed will distribute the load between themselves and the center plate without increasing the friction on their faces, a resistance that results in increased flange wear and a consequent hard-pulling train. This position, it would seem, has been reached in individual cases by an inability to construct body or truck bolsters with sufficient rigidity to carry the load on center plates exclusively, the failure to get proper strength in bolsters being generally due to lack of available space between body and truck. This, however, cannot be said to have the same influence in new equipment, for bolsters can be, and are, made to hold up. But it must not be forgotten that stiffness is of equal importance in each bolster—any lapse in one affects the other, no matter how well it may be fitted to do its work, and the side bearings again come in for a share of the load.

Practical tests have shown that side-bearing friction is an element in train resistance on curves, likely to be in excess of accepted figures for such cases, and give unmistakable proof of the necessity for relief at those points by an entire removal of the load, or at least a large percentage of it. The latter may be done by roller bearings that roll, and there is no doubt that such a bearing will be devised at a figure that will make its use possible.

Among the most recent figures in connection with this subject are those presented by Superintendent of Motive Power Mitchell at the Saratoga convention, in which the particulars of a test made with a dynamometer car on the Erie road, of two trains weighing 2,115 and 2,114 tons, respectively. One of these trains was carried on Fox trucks and metal body bolsters, and had a center bearing only; while the other train had diamond trucks and wooden body bolsters, of which only 12 per cent. were carried exclusively on the center plates. Everything was favorable to a fair comparison of the relative resistances of the two trains, there being twenty-one loaded cars in the first train, and twenty-two in the second; in the total length of the trains there being only a difference of 32 feet, or the length of one car. The dynamometer showed an average draw-bar effort of 12.84 pounds per ton for the train that was carried on the center plates, and 13.89 pounds per ton for the train that had 12 per cent. of the cars supported on the center plates. The full significance of these figures are best appreciated when it is understood that 1.05 pounds per ton more of an average drawbar pull was required to pull the second train than was needed for the train that had no side bearings—in other words, an average effort of 2,220 pounds more had to be exerted to keep the latter train in motion than for the former, at practically the same speed. This is a valuable example of the absorption of power by a resistance that is possible of elimination.

Fans in Sleeping Car.

Every traveler knows the heat and general uncomfortableness of a sleeping car in a terminal station, either at the beginning of a journey or at its end. The advertisement that "cars are open at 10 o'clock," when the train doesn't leave until 12 or later, may catch a fellow once, but has no attraction after the first dose. Some even get the impression that the porter turns on the heat to rout them out in the morning or show his complete sovereignty.

In reality it is simply the lack of ventilation which causes the increase of heat, and this is of course the same at either end of the route, either before or after taking.

The Baltimore & Ohio Southwestern Railway have made an innovation in this respect, which deserves the praise and patronage of travelers generally. They have a 16-inch electric fan in each end of their sleeper, and as soon as the car arrives at a terminal, or before it starts out, these are connected to the station electric-light circuits, and between the two the car is kept comfortable. This is a scheme which doesn't cost very much and is sure to attract travelers. This has since been adopted by the Baltimore & Ohio Railroad as well.

Light Weight of Cars.

Official action has been taken by the Executive Committee of the Master Car Builders' Association, with the view of having correct light weights stenciled on freight cars. This is a move that is forced to the front by the tonnage system of loading locomotives, by which it is required to know, with some degree of accuracy, how much a car weighs empty, in order to compute the gross tonnage of train.

It is not commonly understood that the weight of a car is a variable quantity, getting lighter with age, and should therefore be periodically weighed, so as to insure an agreement between the marked weight and the facts. The influence of erroneous weight of train in affecting earnings on the tonnage basis of loading, becomes apparent when a car may be, and often is, several hundred pounds lighter than the marked weight, and any effort looking to greater accuracy in this regard cannot but be profitable to all concerned. It is hoped that the circular on this subject from Secretary Cloud will get the full attention it deserves.

Underground Cars.

The Waterloo Underground Railway, the latest in London, is the only one which runs between terminals without a stop and does not come to the surface at any point. The shops, however, beside which the photograph of the cars was taken, are in an open cut, about 18 feet below the surface. It is 1½ miles long.

The cars are of American make, being supplied by Messrs. Jackson & Sharp, of Wilmington, Del.

WATERLOO UNDERGROUND MOTOR CAR.

Did Napoleon Invent the Sleeping Car?

A sort of protest has been repeated a great deal lately in American journals to the effect that public opinion is mistaken in supposing that George M. Pullman was the inventor of the sleeping car. Pullman did not invent the sleeping car, any more than James Watt invented the steam-engine or George Stephenson the locomotive. But there never was a car in which comfortable beds were provided until Pullman showed how it could be done. In 1838 cars with sleeping berths were put on what is now the Pennsylvania Railroad, between Baltimore and Philadelphia, and much boasting was done about the comfort and luxury of the cars. The time was not yet ripe, however, for sleeping cars, and those were taken off after a few weeks' trial because they were not patronized. That was the beginning of a series of attempts and failures which were repeated on a variety of railroads, until experience, profiting by previous mistakes, and ingenuity, ever active to invent improvements on old forms, produced sleeping-car berths that people were eager to patronize. As early as 1850, two or three of the long railroads began putting sleeping berths in their way-cars (brake vans) for the use of stockmen in charge of cattle. The berths were little better than wide shelves that were hung from the side of the car, but they served their purpose. This making an upper berth by a movable shelf hinged to the wall led to a celebrated lawsuit between two leading sleeping-car companies years later. One company claimed that it had a patent on the device, and the other contested the plea on the ground that the plan was old. Evidence was presented proving that the hinged shelf had long been used for making sleeping berths; and among other facts it was shown that the carriage which Napoleon used in his campaigns, and now to be seen in a museum in London, contains provisions of that kind for making up a bed. If Napoleon devised that means of promoting his comfort and conserving his energy, which is not unlikely, he was the inventor of an important element in the modern sleeping car.—Angus Sinclair, in July *Pall Mall Magazine*.

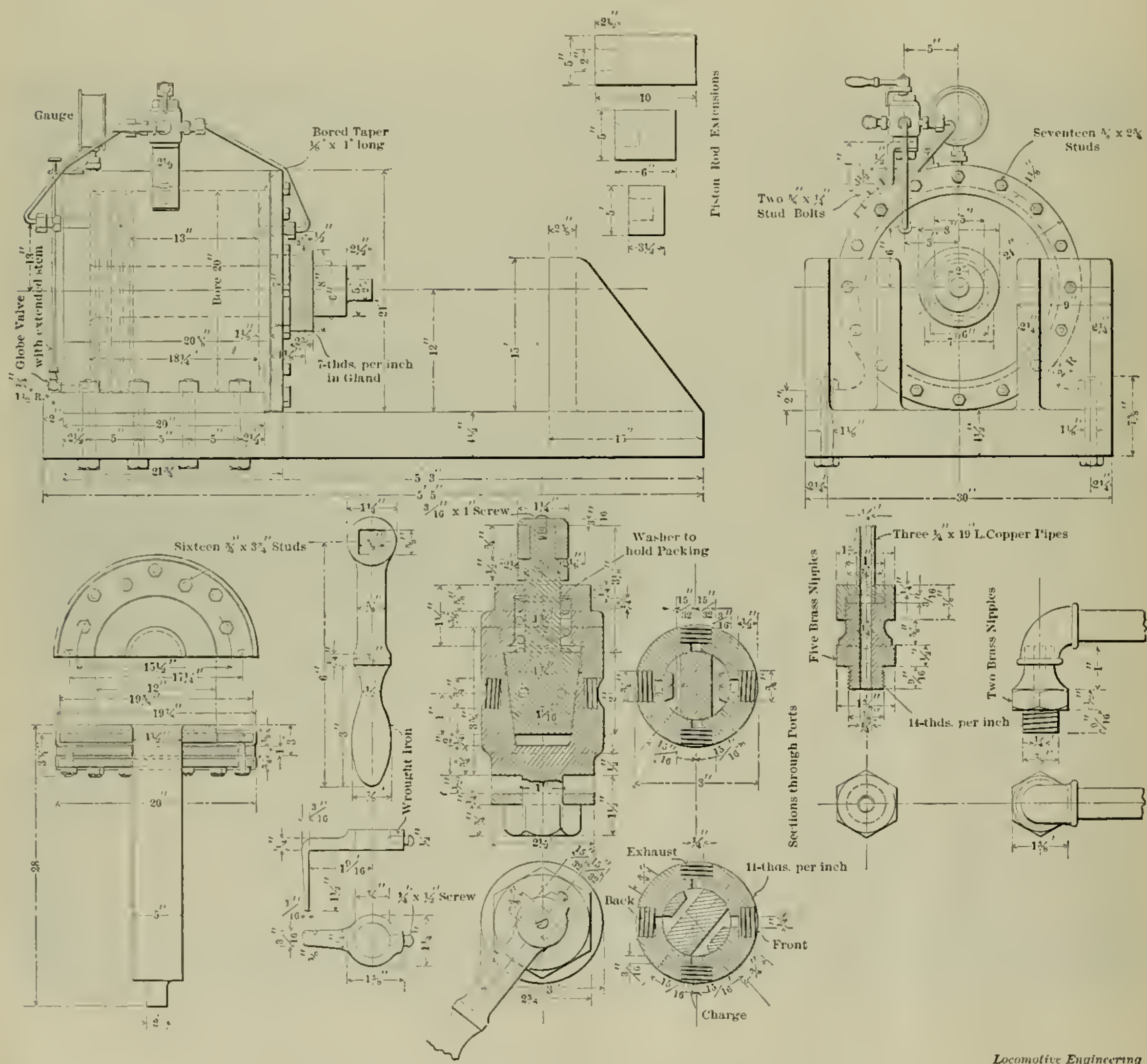
Rules of Interchange.

We have received a circular letter from the Master Car Builders' Association calling attention to the advisability of stencilling the correct light weight on cars. All car owners are requested to give this careful attention to facilitate loading locomotives on a tonnage basis.

We are also advised that the Rules of Interchange, recently revised and to go into effect on September 1st, are ready for distribution as follows: Twenty-five copies, $1; fifty copies, $1.75; one hundred copies, $3; less than twenty, 5 cents per copy. Requests for copies should be sent to John W. Cloud, secretary, 974 Rookery, Chicago, Ill.

Illinois Central Air Press.

One of the best tools of the kind thus far put in commission is shown in the accompanying engraving. It was recently built at the Burnside shops of the Illinois Central Railroad, which are under the supervision of Master Mechanic J. W. Luttrell. The machine was designed and built for heavy presswork like driving-box brasses, hand-car wheels, bushings, etc., and care was taken to provide for and the piston has a movement of 13 inches. The cylinder is bolted to a cast-iron base plate which is 4½ inches thick, 30 inches wide and 65 inches long, having a lug 2 inches thick and 2½ inches high at one end for a cylinder stop, and a vertical extension 15 inches high at the opposite end with the center cut away, to hold the work against the pressure of the piston. This top is heavily ribbed and square with the working face of the Air pressure is 120 pounds per square inch, furnished by a Rand compressor with high-pressure cylinder 15 x 30 inches and low-pressure cylinder 26 x 30 inches. With the pressure carried there is a total force of over 37,000 pounds available on the piston, which places the tool in the category of useful shop appliances, designed with the end in view of allowing its operation with the least exertion and waste of time, as is shown by the location of the base plate



AIR PRESS USED IN BURNSIDE SHOPS OF ILLINOIS CENTRAL RAILROAD.

every call likely to be made in its line of work. General Foreman Place and Machine Foreman Hatz were called into counsel, and the tool assumed shape for a definite purpose, new from the start, with not a part in its make-up that ever did duty before in any previous capacity. That is where it is different from the majority of tools used for an air press, and is what constitutes its chief value.

The cylinder is 20 inches in diameter, base plate. Air is admitted to the cylinder through a four-way plug cock held to seat by a helical spring. Both ends of the cylinder are in communication with the cock by means of ¼-inch copper pipes, which allows the piston to be moved in either direction at pleasure, and owing to the small bore, affords the best kind of a safeguard against shocks when pressing out brasses or bushings, as the piston is under control of the operator at the valve. at the floor level. This machine will satisfy the inquiries of some of our readers who have been interested in the subject of air presses for railroad shops.

In a very neat pamphlet the Lidgerwood Manufacturing Company show the advantages of their safety derrick engine. It is almost a story without words, the illustrations making a strong argument in its favor.

Locomotive Coal and Ashes Handling Station.

The Philadelphia & Reading Railway Company are having installed on the new subway, in Philadelphia, a very complete coal and ashes handling plant. The ashes machinery will be the first of its kind to be introduced at a locomotive station, though this type of machine has demonstrated its efficiency and durability in handling ashes in industrial establishments.

The plant is to consist of an iron building with capacity to store 1,000 tons of coal and 40 tons of ashes, together with the machinery to deposit the coal in storage, whence it is fed to tenders as required, and for receiving the ashes from locomotives and placing it in storage preparatory to its being hauled away in cars. The coal machinery will handle 2 tons per minute, and the ashes, 20 tons per hour. Fourteen tenders may be coaled at one time, and ashes may be taken from ten locomotives simultaneously.

The coal as dumped from the incoming cars falls to a steel-lined track hopper, and is fed through a regulating gate to a bucket elevator, which delivers it to a conveyor running through the top of the storage pocket. In the bottom of this conveyor are a number of discharge gates through which the coal drops to the eight bins forming the pocket. Eight tracks are spanned by these bins, and thus a corresponding number of tenders may be coaled at one time under the pocket proper.

Assuming that a locomotive has been brought into position for coaling, the fireman reaches from his tender and lowers to it the hinged portion of a chute projecting from the floor of the bin immediately above. The fixed part of this chute being fitted with a regulating gate, the flow of the coal cannot be violent, and the operation of coaling having been completed, the locomotive is free to move from under the pocket, the fireman having first swung the hinged end of the chute into its inoperative position, where it is clear of the locomotive stack.

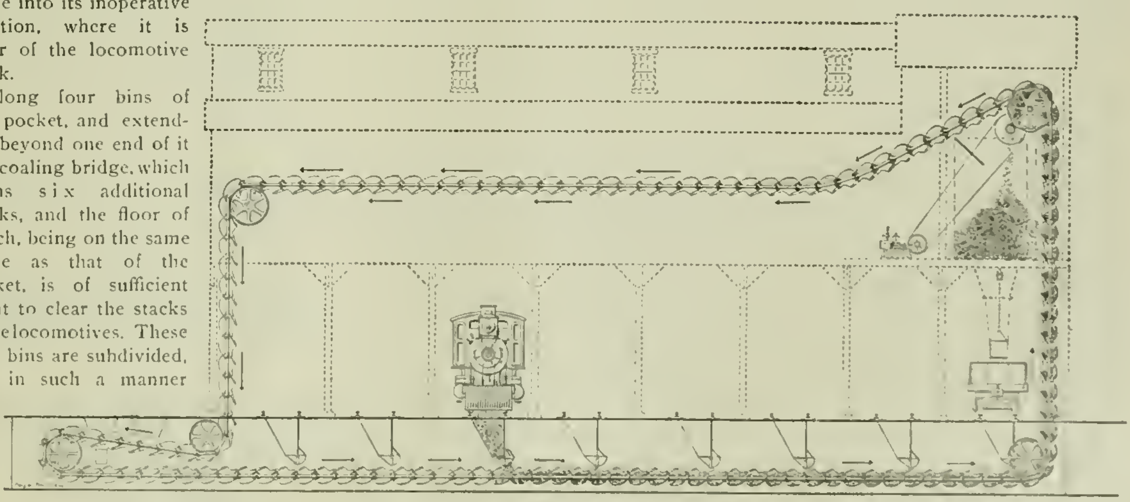
Along four bins of the pocket, and extending beyond one end of it is a coaling bridge, which spans six additional tracks, and the floor of which, being on the same plane as that of the pocket, is of sufficient hight to clear the stacks of the locomotives. These four bins are subdivided, and in such a manner that coal placed in them by the overhead distributing conveyor may not only be automatically fed to the tenders brought under the pocket, but also to hand cars on the coaling bridge. There are two tracks and four turntables on this bridge; so that the cars, which are bottom dumping and of 2 tons capacity, may be handily drilled to the storage bins for loading and to the openings in the bridge for discharge to the tenders on any of the six tracks beneath.

The elevator referred to is of the gravity-discharge type, which meets the requirement of large capacity without breakage of the coal or rapid wear and shock to the machinery by using large buckets and running at a low rate of speed. The buckets are centrally hung between, and rigidly attached to, two strands of chain, and in passing through the foot of the elevator scoop up their loads, which they elevate to the top of the pocket and then convey along a short horizontal run, where they serve as scrapers, pushing the coal before them and gently dropping it to the horizontal distributing conveyor.

An interesting feature of this distributing conveyor is its flights, which are kept from coming in contact with the sides and bottom of the trough by being suspended by means of wearing blocks attached to their ends, an arrangement that not only eliminates noise, but insures long life to the flights, as well as to the trough. The monobar chain to which the flights are attached and the equalizing gears which drive the chain are also interesting details of this conveyor. The bolts are of 1-inch wrought-iron indicating great strength. When watching monobar in operation, it will be observed that it is free from destructive, power-consuming, pulsating motion found in chain mechanisms where the links are of long pitch. (The monobar in the P. & R. plant is 24-inch pitch.) This advantage—the counteracting or equalizing of the throbbing motion—is gained by the use of equalizing gears, a comparatively recent innovation in driving machinery.

The illustration is a side view of the storage building, which, it should be explained, is "L" shaped. In this cut the coal-handling machinery is not shown. At the right-hand end, and in the long portion of the "L," is the gravity-discharge elevator. In the lantern of the building runs the distributing conveyor, and over and beyond the loop at the left extends the coaling bridge. In the small arm of the "L" is located the 40-ton ash pocket, and the illustration is intended to show this pocket and the machinery which receives the ashes from the locomotives and takes it to storage. It will be noticed that there are eight ash hoppers under storage building, and that the ashes-carrying machine is extended in the form of a loop, so that it will receive from hoppers of two additional tracks. Each of the ten hoppers is fitted with an automatic gate for feeding the ashes to the combined conveyor and elevator, known as an open-top link-belt carrier, which deposits it in the pocket in the manner shown. This machine consists of a continuous line of buckets rigidly attached to two strands of chain, and is particularly adapted to the handling of such an abrasive material as ashes. None of the ashes can fall outside of the overlapping buckets when being fed to them by the automatic chutes, nor can it spill from them until they become inverted at the head wheels. Thus it will be seen that the ashes cannot come in contact with, and so produce wear upon, the working parts of the machine. The durability of the carrier is further increased by its being fitted with a self-oiling device, which thoroughly lubricates the chains at their points of articulation, as well as the axles of the small wheels which support the buckets on the horizontal runs, and also effects quite a saving in power.

The Link-Belt Engineering Co., of Philadelphia and New York, have designed and are erecting this modern-method plant.



LOCOMOTIVE ASHES-HANDLING STATION.

A Railroad Man in the Volunteer Army.

The readers of Locomotive Engineering will doubtless be interested in the experiences of a railroad man in the volunteer army. We were having lots of hard work the few days previous to my enlistment. We had caught the local freight four days out of the seven in my last week; but let me say, if you please, that this had nothing to do with my going into the army. I always enjoyed being busy. Nothing is so detrimental to one's very happiness as idleness. It is always in one's idle moments that sin creeps in, and ofttimes robs the man of all that goes to make his life a pleasure and a success. Don't complain, boys, if you are worked a little hard sometimes. That very hard work that you curse has often been a greater benefactor to you than you can see.

I had talked over the proposition of going into the army with my conductor, and also with my partner that rode on the hind end, but they were very emphatic in their statement that they had lost no Spaniards. The engineer and fireman that pulled us the last few days could see the matter in a little different light; but still I was unable to pick my partner for the army from either end of that train.

Locomotive Engineering expresses in its last issue, that there is a vast deal of patriotism among the railroad men of the United States. This is true and very true; and I feel that I might look a long time before I could find two more men who thought as my conductor and my hind brakeman did. I had resolved to go. I could not be persuaded to the contrary. But I must have a partner. I happened to think of a young man working in the shop (helping machinist), that I knew had served three years in the Eighth United States Cavalry, and I lost no time in looking him up. I was to enlist with the Third United States Volunteer Cavalry (Grigsby's Cowboys), and the idea of cavalry just suited him, and he said, "I'll go."

There was one more trip to make, so I went around, and found I was marked out on an extra East. We were sure of one of the through freights back, so I retired for the night, happy in the thought that my last trip would be an easy one.

The unexpected always happens. We were delayed on our extra East, and once more caught the local back. Everything had gone well until within four stations of our division point on our return trip. We had just finished unloading 4,700 pounds of molasses and whiskey barrels, when our conductor gave an out-of-town signal and we were gone. Everyone gets in a hurry when nearing a division point, and it was not long before our train was rolling along at a good speed. I had caught the way-car, for a drink and a little talk with the hind man. We had ten cars of air ahead, all loads, with fifteen non-airs next the way-car.

Our engineer was only a couple of miles out of town, when he was flagged by the section man, who had a piece of track up and did not have it tamped in as yet. A recruit section man was sent out with the flag, and the engineer thought from the intensity of the signal that about four miles of track were torn up, so he stopped. The way-car, it seemed to me, was the first to stop. I had often heard of stopping the hind end first, but this was the first practical demonstration I had ever had. I was just opening the front door of the way-car to go out on top. I did not get the door open, but I went out through it just the same. I didn't say a word—out loud, but I did say to myself that if fighting Spaniards could be any worse than that I was willing to take my chances with the Spaniards. My mind was thoroughly made up, and after this experience I was resolved to try and persuade our engineer to go also. I explained fully to him that he would be an invaluable man. I told him he would be very successful in killing Spaniards, if he could only get them in the way-car on a part-air train. He was insulted, of course, and I came very near getting whipped before I had even been recorded as one of Uncle Sam's defenders.

They were recruiting in our division town, and I lost no time in being on hand at recruiting headquarters at 9 the next morning. You know how natural it is for a railroad man to be on time; this fact accounted for me being the only one in the general waiting-room at the hour of nine. A little round-faced doctor in a uniform stuck his head out of the doorway of an adjoining room, and called out "Next." There seemed to be no question as to my being next; so I arose and accepted the doctor's invitation to come in. The first thing to attract my attention was his uniform, and I learned afterward that the two little silver bars in each end of his shoulder straps signified that he held the rank of Captain and was an assistant surgeon in the United States army.

"Take off your clothes," said the Captain. "All of them?" says I. "Yes, every stitch, and get them off quick, too. We have orders to rush this recruiting, and have no time to waste." How lucky it is, said I to myself, that I had the misfortune to fall in the creek yesterday. I could not help thinking, however, that if some of the firemen I know should have showed up there for an examination, the doctor would certainly have found a high-water mark on each arm, a low-water mark on his neck, and a no-water mark on both feet.

The doctor first took my chest measure, and while his little steel tape encompassed me he asked me to exhale all the air out of my lungs, and then he had me inhale as full as I possibly could. He noted the expansion, 3 inches. "Why don't you use all your lungs?" said the

Captain. "I do, sir," said I. "You will pardon me, but you certainly do not," said the doctor. "Try that again; you don't more than half fill your lungs." I did, and I could actually feel some of the air cells of my lungs open up, that I presume had been closed for business for some time past. When I realized what was wanted I found no trouble in exceeding the necessary expansion of 4½ inches. You see, I had made a practice of doubling myself up over the front end of the fireman's seat-box, and not more than half filling my lungs, until a portion of them had actually gone out of business. After satisfying himself as to the working capacity of my lungs, the doctor drew forth from his little satchel an instrument that reminded one of the "Drop a nickel in the slot and hear Annie Rooney" machines—a little piece of apparatus that resembled a guide-cup cover, having two little rubber hose with tips on to fit the ears. He placed the little machine over my heart, and by putting the ends of the rubber hose in his ears, established telephonic communication. He counted seventy-six beats per minute, and remarked, "That's all right—only four above the normal heart-beat;" and then he asked me to listen to my heart beat. I told him I had felt it beat several times before, in my throat, but I would be pleased to listen to it. It resembled the pounding of a flat wheel very much.

I was given my enlistment paper and was sent out to the mustering officer to be sworn in. Before swearing me, he put some questions to me as follows: "According to the act of Congress, calling for three special regiments of cowboy cavalry, the requirements are stated as follows: They must be frontiersmen, good riders and good shots. I see you have given your occupation as a railroad man. I don't quite see that you will fill the requirements." I explained to him that I had not always worked on the railroad. I told him that I had come to the Black Hills country in 1889. I had come through from Texas with a bunch of steers. Cowboys are always modest, and I explained to him that I was not much of a shot myself, but that some of my partners that came through from Texas with me could shoot a candle out without breaking tallow at 150 and 200 feet. "That will do," said the mustering officer; "hold up your right hand and be sworn. You do solemnly swear that you will bear true faith and allegiance to the United States of America, and that you will serve them honestly and faithfully against all their enemies whomsoever; and that you will obey the orders of the President of the United States, and the orders of the officers appointed over you, according to the Rules and Articles of War. So help you God." "I do," was my prompt answer.

My partner was re-enlisted on his discharge papers, and as we were about the last mustered, the next day we were moved to a convenient point, where more troops of our regiment could join us. We understand we are to go very soon to Camp Thomas, Chickamauga Park, Ga. In the meantime, however, we must start the drill. Our drill instructor took us out the first day, and gave us the position of the soldier—heels on the same line, and as near together as the conformity of the legs will permit. I had no trouble in getting my heels together; but my knees—my legs had been wrapped around a broncho for so many years, that to get my knees together was impossible. Body erect on the hips, and inclined slightly forward; your chest well out and your stomach well back. Our instructor explained that the stomach should not be, and in fact was not, a prominent thing in the army. It only took a few days' experience with the government ration to prove the above statement beyond any question of doubt.

I would like the railroad boys to learn one of the first lessons we volunteers learned from the regular United States troops. Our volunteer squadron was nearing one of Uncle Sam's military posts not long since. Before we got to the garrison we met many soldiers out riding their wheels. We all discovered that as they passed our flag at the head of our column, they all removed their hats. We thought perhaps that it was only the privates in the army that saluted the colors. We soon found our mistake, for as we drew up in front of the Colonel's headquarters we found him standing in front of his office, and as the colors passed, the Colonel removed his hat. Say, boys, it's the best lesson I have ever learned. If you can't go to Cuba, you can remove your hat to the Stars and Stripes—emblem of the proudest and best government on the face of the globe.

R. A. LEWES.

Joke on the New Superintendent.

The college-bred man who was advanced to the position of superintendent through nepotistic influences, and gave orders to have all cars standing on side tracks moved once a day, so as to prevent them from getting flat wheels, has found his equal in another man who had influence without experience, and when he found that the observation platform on the limited was crowded and passengers could not get a seat, ordered the trainmasters to have another observation car attached at once. The trainmasters wrote to the superintendent to ask if there was enough clearance in tunnels and bridges to have the observation platform of one car placed on the roof.—*Pittsburg Post.*

If there is no club at your point better write us for an outfit.

Allston Shops of the Boston & Albany.

The old Boston & Albany Railroad shops, so long located at South Boston, have at last been engulfed by the tide of improvement that has been quietly making itself felt on that system, and the prestige they once held, as the scene of advanced thought in motive-power matters, is all that remains of the old plant. All tools and shop equipment have been removed to the newer shops owned by the company, at Allston, near Boston, a plant built on very liberal lines, and heretofore devoted to car work exclusively, but amply large to take care of the work of both departments.

What had been the car-erecting shop, a room 200 x 65 feet, is now devoted to the uses of a locomotive-erecting shop. This shop, which has eight tracks, could hardly have been designed to give better facilities for the work, than those found ready at hand when the moving was completed. The trussing of the roof furnished the best of opportunities for a small traveling crane over each pit, an opening that was quickly taken advantage of by suspending a 7/8 x 3½-inch rail from the chords of the trusses, on which a small four-wheeled trolley is carried with a differential pulley-block good for a cab or stack. These cranes are a feature of the new shop that would very likely have been indefinitely in the dream stage, but for the architect building wiser than he knew. A circular crane of 10 feet radius is placed at the radial drill located in this shop for handling frames, and it has been found incidentally to be a time-saver in the fitting of driving boxes to journals.

The wheel work is done in a room 50 x 65 feet, adjoining the erecting shop. Three driving-wheel lathes are located on one side, and the axle lathes and wheel-mounting outfit occupy the opposite side, together with the bolt and nut machines. A platform is built on the roof chords in this room, on which is located the small tools for brass work. The idea of elevating the small tools from the ground floor was also followed out in the case of the bolt and nut threading machines; the latter, however, being simply on a raised platform.

In the machine shop, which is 100 x 65 feet, the rest of the belted tools are placed transversely, which makes an odd appearance at the first glance; but the reason of it is apparent when the location of the engine is seen to be such as to run the shafting in that direction. The rod gang is also in this shop. The mill of the wood-working shop adjoins the machine shop, and is of the same dimensions, while the freight erecting shop is next to the mill. These shops are under one roof, and by checking up the figures, they are shown to be of considerable size. There is, however, one thing that would impress the observer in looking them over, namely, that they were well designed for the purpose of doing railroad work. As a matter of fact, they were not designed for the present arrangement of the plant at all. It is simply a stroke of good fortune that the buildings can be so well adapted to the work of the motive-power department. If they had been designed for the present uses, it is doubtful if they could be improved in many respects for such a combination of interests.

The wonderful performance made by the United States battleship "Oregon," in steaming from San Francisco to Key West without a breakdown in her machinery, and reporting immediately upon her arrival for active service, has won the admiration of all classes of engineers, particularly those interested in marine machinery. To have been able to make this record, it was absolutely essential that all parts of the machinery should be of the best. The superiority of hollow forgings over solid forgings, in this case, is made very apparent, as the crank shafts, line shaft, thrust shaft and propeller shaft were all made hollow, having a 6-inch hole through them. They were manufactured at the only forge in this country prepared to do work of this magnitude, namely, the Bethlehem Iron Company, South Bethlehem, Pa.

Among the new things at the convention we noted the Facer solid forged steel truck wheel, hammered to shape under the steam hammer, in dies from the ingot. These wheels have every appearance of a mechanical job. They are finished in the dies so as to have a hub, plate and rims very similar to the built-up wheel in appearance, the plate being 1 inch thick, and the rim and flange on lines quite like an ordinary steel tire. The inventor states that it only requires eight minutes to forge on one of these wheels from the blank.

An American inventor has applied for a patent on a double smoke-stack locomotive, in which one stack is to be employed to carry away the exhaust steam and the other the gases of combustion. On the principles of induced currents we should say that the thing would not work, but the inventor, who called at the office of Locomotive Engineering for aid in booming his invention, says that it has been tried on several locomotives and produces an important saving of fuel—from 10 to 20 per cent.

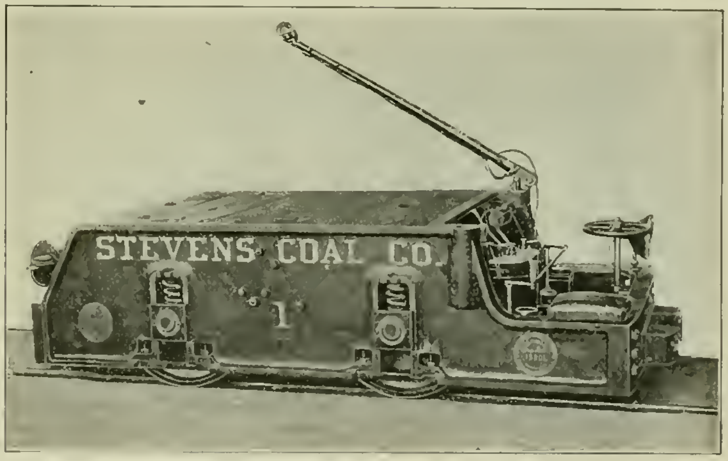
The Falls Hollow Staybolt Company recently shipped a lot of their hollow staybolt iron to the Richmond Locomotive Works, for use in engines for the Brainerd & Northern Railway. We are informed that this was fine No. 1 charcoal iron, chemically pure and made by improved methods.

A Rack for Tool Rooms.

A tool-room rack for taps, dies, reamers, and other tools constantly passing in and out, is, in general, either too large or too small; in a large majority of cases it is the latter, for the reason that the average tool room develops quickly beyond the lines laid down, and the result is, that what was expected to be of a slow growth is soon filled up and running over at the sides.

To best meet such a condition, it is necessary to start with a system that can expand with the increased demands made for proper tool space, and one of the best plans we have seen for the purpose is that which can be made to take care of an increase at slight expense, as devised by Master Mechanic Turner, at the Wilmington shops of the Philadelphia, Wilmington & Baltimore Railroad.

Briefly, the scheme consists of a series of columns made of ½-inch tubes extending from floor to ceiling in the center of the tool room, so as to be accessible from all sides. The tubes are spaced about 15 inches apart each way, and are connected together by flat iron ¼ x ¾ inch, at intervals of, say, 6 inches, by U-bolts encircling the tubes and passing through the flat. On these flat bars rest cast-iron pans or trays, about ¾ inch deep, flanged on all sides, and wide enough to just fill in between the tubes. It is seen that this idea may be started successfully with four columns and one tray, or it may be amplified until the room is filled, if need be, by erecting more columns and building on as required.



ELECTRIC MINE MOTOR—BALDWIN.

A Reporter's Locomotive.

A reporter on the Topeka *Daily Capital* is responsible for the following:

"Material has been ordered by the Santa Fé for the largest locomotive ever built. The engine has been designed for mountain climbing, and it is said that the big Player engines and those built for the Santa Fé by the Dickson Locomotive Works will be but playthings when compared with this giant locomotive.

"The engine will be built by the locomotive department of the Santa Fé shops in this city. Among its features will be a boiler built of 1-inch boiler steel, and cylinders whose dimensions will be 12 by 32 inches. It will have no 'pops,' as they will not be required. No fireman living would be able to build a fire that would create enough steam to burst the boiler of this mogul. The engine will have ten drivers, and it is estimated that it will be able to haul a third larger load than any engine the Santa Fé now has."

Those 12 by 32-inch cylinders would make good field mortars for siege purposes, and the 'popless' boilers will also be a curiosity. Perhaps no fireman can build a fire that would burst them, but if the reporter wants a lightning trip into the next world, he had better sit on one of these boilers and try it.

Best of it all is, Mr. Player writes us that no large engines have been ordered.

The Boston & Maine Railroad Company are giving all the encouragement they can for tourists to visit the White Mountains and other popular resorts on this railroad. The American Institute of Instruction held an annual convention at North Conway, N. H., in the beginning of July. This is said to be a most attractive place, and is an excellent location for a convention. We learn that it is capable of accommodating 2,000 visitors, and the railroad company are always ready and willing to provide cheap and comfortable facilities for reaching the place.

There is no doubt as to arithmetic being the foundation of all education and the little book, Machine Shop Arithmetic, gives the part a mechanic needs. 50 cents.

The Moran Battleship.

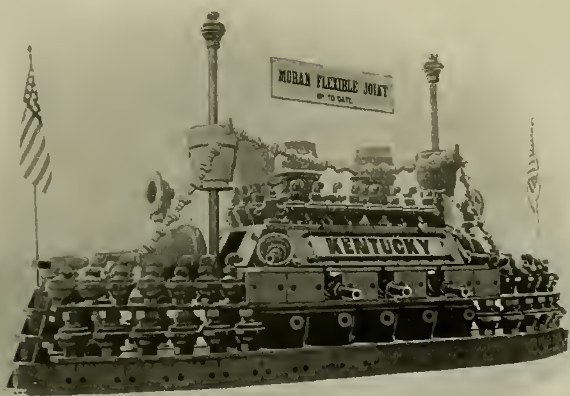
The accompanying engraving shows a very neat exhibit, at the Saratoga convention, of the Moran Flexible Steam Joint Company, of Louisville, Ky. The illustration renders little description necessary, as the representation of the battleship "Kentucky" is exceedingly good. It was a happy thought, and was well carried out.

An Expensive Railroad.

Mr. Frank H. Carpenter, writing about the principal railroad in Peru, says:

"This road is said to have greater excavations than any other line of similar length. It is one of the most expensive roads ever built, having cost $44,000,000 for a line of 327 miles, or an average of $135,000 a mile. The road reaches an altitude of 14,666 feet in crossing the Andes to the plateau of Lake Titicaca, and here where it ends, the altitude is higher than the top of Fugiyama, the sacred snow-capped peak of Japan. It has a branch line of 122 miles going over the plateau to within two days of Cuzco, the famed capital of the Incas. This railroad was built when Peru was rich and when she was squandering fortunes on such things. It is the work of an American engineer, Meigs, and is one of the greatest engineering feats of the world. There is talk of extending it into Bolivia, and it may sometime be a part of a transcontinental line reaching to Paraguay and the Argentine. At present it belongs to the Peruvian corporation, the English syndicate which took Peru's railroads in consideration of relieving the country of its foreign debt, but it is managed by an American, Mr. Victor H. McCord, who keeps it in almost as good condition as any road you will find in the United States. All of the rolling stock is American in pattern, though of late the cars and engines have been made by Peruvians in the company's shops at Arequipa. Arequipa is the halfway station on the road to Lake Titicaca, and it is there that the general offices of the road are situated.

"I visited the railroad shops and found 400 Peruvians engaged in all kinds of car construction. They make engines as good as any used in our country, and have some which are especially adapted to the heavy grades of the Andes. The shops are in charge of an American, a Mr. Beaumont, of New Jersey, but all of the men are Peruvians. Mr. Beaumont told me that of the 1,000 hands employed in one capacity or another on the road, there were not more than ten foreigners. It may interest our railroad men to know the wages which their kind receive down here. I give them in American gold values, and not in the silver in which they are paid. Trackmen receive 75 cents a day, and brakemen a similar amount. Engineers get $100 a month, and conductors are paid from $30 to $65 a month, according to position and length of service. Men employed in the shops get from 75 cents and upwards per day. There are no trades unions and the men never strike. They work nine hours a day, and with those who are out on the road the day lasts, without extra pay, until the cars come in."



THE MORAN BATTLESHIP.

Three of the cars which are now in service on the Royal Blue line contain ladies' retiring rooms. These apartments are 8 feet long, and are provided with beautiful full-length mirrors, cushion settees, stationary dressers, bookcases, and all possible conveniences that can be found in a lady's boudoir. The finishing is artistic and beautiful. The Pullman Company is also beginning to pay more attention to the comfort of ladies in the sleeping cars, and the plans for the new sleepers provide for great deal better accommodations than have been given heretofore. The new parlor cars are the longest of the kind ever built, being 70 feet in length, exclusive of platforms.

A Case of Quick Action.

The necessity of prompt action to keep an engine from laying down, was forcibly brought home to us once on the Northern Pacific, when the "338" began to loaf on Muskoda hill with a string of box cars, one night not so many years ago, and getting nearer No. 7's time every minute. Howard Curry, the engineer, knew that the machine was good for all the loads behind her, and more, and while the pops were letting go ever and anon, as if the music of the flutter would incite the old girl to renewed efforts, the speed gradually went down to a crawl.

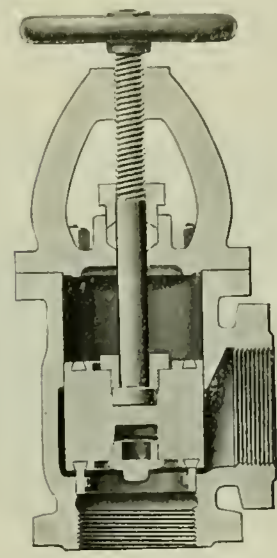
The cause of this unusual performance was the binding of the driver-brake shoes on the high side of the curves, for which the hill referred to is notorious, and when the engine struck one of these, she tipped just enough to draw the brake shoes up to the wheels. No general in the heat of the fray ever formulated a scheme and put it in execution quicker than Curry, when he discovered what it was that held him up on Muskoda.

No time was to be lost; placing a torch in our fist and a big monkey-wrench in his own, a quick pantomime laid down the plan of action, and, jumping from the gang-way, we held the torch, walking along ahead, while that wrench was getting in its work on the cam screws each time the side rod got out of the way enough to permit it. This was no easy trick, even if the engine was going slow, and the participants in it will not soon forget the lively moves in that wet grass, waist high; for the wrench had to be put on, turned and taken off again before the rod reached the scene of operations. It was worth the wetting to see the engine respond to the decreased resistance, and to know that her tractive effort was not oozing out at those brake shoes. She did not quit, but took 'em in to clear No. 7, because her runner found what was the matter and used a remedy just in time.

The Trade Journal Review, of London, commenting on an article that appeared in LOCOMOTIVE ENGINEERING, on anti-friction alloys, says: "There are other reasons connected with the nature of the white alloy which are not referred to. The writer says truly enough that it is only when the parts run dry, or get hot and want to seize, that the virtue of white metal asserts itself and keeps things going for a time. In the first place, the metal has a greater heating conductivity, and so, for a given friction, induces less heat, and therefore less expansion in the bearing. Secondly, when the metal runs, it acts as a lubricant and prevents seizure for a while; for evidently the 'brass' cannot seize the pin so long as a layer of this fluid metal is interposed. When this is all thrown out the trouble begins. An engineer's nose is usually his sentinel in such cases, but often the first intimation comes from the white metal, which by giving timely warning enables him to avert the catastrophe. When the 'threepenny bits' begin to fly, the runner knows it is time to think about giving up his train. It is no use trifling with a hot main pin, especially if the engine is inside connected. In such a case the driver would have a hole knocked through his boiler or his firebox front before he knew where he was. So much for the safety gained by the use of Babbitt, and, in fact, all bearing alloys."

A New Blow-off Valve.

The Lunkenheimer Company, of Cincinnati, Ohio, are about putting on the market a new blow-off valve. As will be seen from the cut, the disk is solid and fits



NEW BLOW-OFF VALVE.

the barrel closely, to prevent scale or sediment lodging on top of disk.

The disk is reversible, having a seat on each face. These seats are of babbitt, dovetailed in as shown, so they can be easily renewed. The brass seat ring can also be easily renewed. They are usually made with an iron body, but for marine use bronze is used. They are also made either screw or flange end as desired. Further details can be obtained from the makers.

W. D. Sargent, president of the International Brake Shoe Company, left this week for Europe to make arrangements for the manufacture of the Diamond "S" shoe in several European countries, including Russia. The success of this shoe since its introduction last fall has been little short of phenomenal, and we doubt if any railway device of recent invention has been so thoroughly and consistently pushed on all occasions as this brake shoe.

Geared Locomotive.

This is a 20-ton Climax locomotive built by the Climax Manufacturing Company, of Corry, Pa., for the Harlow Lumber Company, of Harlow, Kan. There it is hauling eight cars of lumber over a roughly laid road, on 25-pound rails, around sharp curves and up 5-per-cent. grades (264 feet to the mile).

All the working parts are in open view, and are easy of access for repairs, as well as being both adjustable and interchangeable.

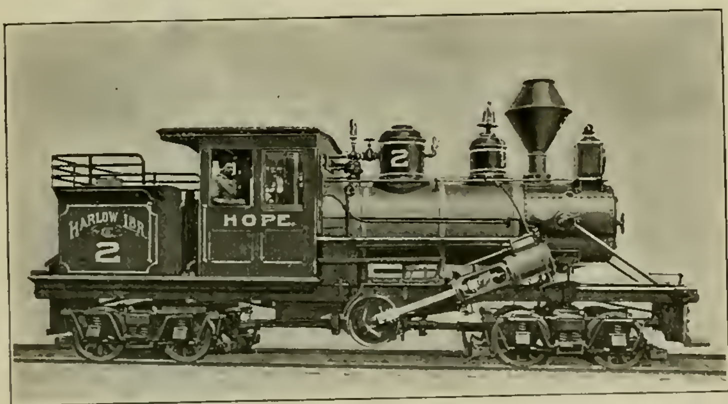
Placing Enginemen Between the Devil and the Deep Sea.

A very sensible article has been written for the *Railway Age* by Mr. J. H. Goodyear, of the Chicago Great Western, in which he makes the following comment about the disagreeable position that enginemen hold in relation to the superintendent and to the master mechanic. He says:

"In the superintendent and general master mechanic, we have two officials belonging to the same department, having authority over enginemen and the engines they handle, such authority, however, being exercised under different conditions, yet in a manner calculated to place enginemen in the position of having to serve two masters at the same time, each with authority to dispense with their services without consulting the other.

"The superintendent is responsible for the prompt transportation of freight at the least possible cost for train and engine crews, and naturally aims to do the best he can from his standpoint.

"The general master mechanic, on the other hand, is responsible for the efficiency of power furnished, and is directly responsible to the management for the economical maintenance of power, yet his authority as regards the use such power shall be put to practically ceases when the engine leaves the roundhouse track. What is the result? The general master mechanic has a record to make, and can only make it by an economical showing in the matter of maintenance of power and cost of fuel and supplies. To do this he has to be continually getting after enginemen in regard to their coal and oil record and care of an engine. The consequence is, enginemen are between the devil and the deep blue sea—in one ear is shouted, "Economize"; in the other, "Get there." They endeavor to do both, and in their effort to do so take more chances and damage more equipment than a casual observer would imagine. It will also be found that the greater percentage of enginemen discharged are discharged by train superintendents for some cause which seldom bars them from obtaining positions on other roads, provided men are needed. As a matter of fact, it will be found that men with a fairly good record from a mechanical point of view, have, after several years' service, lost their positions for some cause, more or less serious, and their positions, or rather the complement of enginemen, made up by hiring men discharged from other roads for similar or more serious cause.



CLIMAX GEARED ENGINE.

Such a condition of affairs may be for the good of the service as far as discipline is concerned, but it is a question whether it is to the interest of a railway company to discharge, without good and sufficient cause, enginemen, or in fact any class of men, after several years' service, replacing them by men who require several months' service before becoming as efficient as those discharged. The percentage of enginemen discharged is greater than it should be, and as a consequence the tramp engineer and fireman is much in evidence. Is this due to the fact that under existing circumstances enginemen are for the most part being handled by men having no feeling in common with them?"

The chapters on boring engine cylinders and on the alleged improvements in valve gear, in Practical Shop Talks, are drawn to life and will interest any railroad man, whether he is on the road or in the shop. The book costs 50 cents.

The National Railroad Master Blacksmiths' Association will hold its sixth annual convention in Boston, Mass., commencing September 6, 1898. The American House, situated on Hanover street, has been designated as the official headquarters of the association during their stay in Boston.

A letter recently received by the Buffalo Forge Company from the Rookwood Pottery, Cincinnati, O., says: "Your system of pressure heating (Buffalo fan system) continues to give us satisfaction." This plant was installed in the year 1891, and the apparatus involved necessarily has been much improved since that time. Nevertheless the letter indicates the usual record for a fan system installation.

When we looked over the 228 pages of "Routes and Rates for Summer Tours" for 1898, it made us want to go to more places than could be covered in a summer, there are so many that are attractive. The 150 illustrations add to the book, and the information given in the list of 800 hotels is well worth preserving. It also gives more than 600 combination excursions for about all the desirable places in this part of the country, and the seven maps add greatly to its value. It is issued by the New York Central & Hudson River Railroad. Upon receipt of 10 cents postage, it will be mailed to any address on application to Geo. H. Daniels, general passenger agent.

Gold's platform gate lock has recently been adopted by the Long Island, Brooklyn Elevated, Kings County Elevated, Metropolitan Elevated (Chicago) and Illinois Central Railroads. For suburban and similar services this is a very neat device. They are made by Edward E. Gold, Frankfort and Cliff streets, New York.

The International Correspondence School have issued a pamphlet telling the advantages of their text books (they now bind the instruction papers in substantial volumes) for mechanical and practical men. They are fully indexed, enabling anyone to find just what they want with little trouble. The books are extremely valuable to any mechanic or engineer, and the pamphlet should be in demand.

We have received the new leather-covered catalog of the Chicago Pneumatic Tool Company, which shows, by means of excellent engravings, their well-known tools and the uses of each. Any shop man, whether on railroad work or not, will see work being done which is in his line, while the letters printed give evidence of their value. The casting cleaner is a particularly ingenious device which should be a money-saver.

We have received from the Purdue University, Lafayette, Ind., a pamphlet announcing the courses in railway engineering and railway management for the year 1898-1899. The course of study and practice published in this pamphlet makes quite interesting reading, apart from giving the information regarding what is to be done. Those interested in the education of youths, with a view of preparing them for railroad work, would do well to send for this pamphlet.

Within the past month the first iron bridge erected in the State of Ohio has been removed. This bridge was over Salt Creek, on the Central Ohio division of the Baltimore & Ohio Railroad, in Muskingum County, and was built in 1851. It was a single span, 71 feet in length, and was known as a "Bollman deck truss bridge with plate girders." Bollman was at that time Chief Engineer of Construction of the Baltimore & Ohio Railroad.

Lightning frequently plays havoc with electric plants, particularly railways, which are unprotected by efficient lightning arrestors, and a little booklet by the Westinghouse Electric and Manufacturing Company, called "Protection, Not in Fancy but in Fact," shows the latest improvements in this line.

"London and Northwestern Locomotives—Part II.," is the title of a neat little booklet sent us by our British representative, Mr. F. Moore, of No. 9 South Place, Finsbury, E. C., London. It contains illustrations and descriptions of the leading locomotives, both simple and compound, of this road, and makes a very interesting little book. The price is given as 6½d. post paid.

The genial Mr. Chas. Miller, of the Galena Oil Company, has been appointed Brigadier General by the Governor of his State. He is in command of the Second Brigade of Pennsylvania National Guards. If he can fight as well as he can sell oil, Spain should sue for peace at once.

A recent trip over the Lake Shore & Michigan Southern railroad revealed the "floricultural train" at work in beautifying the station grounds along their line. This train carries plants of various kinds and colors and stops at stations to set them out in artistic beds, which add much to the appearance of the stations and are in pleasing contrast with some of the piles of cinder, coal and rubbish which adorn too many railroad stations.

The next convention of the Traveling Engineers' Association will be held at the Genesee Hotel, Buffalo, N. Y., commencing Tuesday, September 13, 1898. A rate of $2.50 per day, per person, has been made by the management of that hotel to the members and their families. The committees in charge of the subjects for discussion have been busy in their preparation for some time, and the meeting promises to be the most successful one of any yet held.

If any of our friends have learned to play golf and to talk glibly of their "bulger brassey," "midspoon," "wooden putter," "goose-neck putting cleek," "centraject mashy," "lofting iron," "niblick," etc., etc., we recommend that they send to the Bridgeport Gun Implement Company, Bridgeport, Conn., for one of their catalogs. It shows how the game is played, and should be in demand by those who desire to learn the language of the golf field as well as to play the game.

We are informed by Mr. J. W. Duntley, president of the Chicago Pneumatic Tool Company, that his exhibit at the railroad mechanical conventions was the means of bringing them a great many orders. The exhibit certainly formed one of the best series of object-lessons that ever were given to railroad men, and the great enterprise displayed deserved substantial appreciation. We understand that on one day, June 27th, mail orders for thirty-eight machines were received by the company, all of them from parties who had seen the machines in operation at Saratoga.

The ten-wheelers of the "1300" class hauling the Royal Blue on the Baltimore & Ohio, double the road every day, covering 300 miles. These engines were received with cast-iron eccentric straps, which have been replaced with brass straps, which have given a record of no break-downs, after a service of nearly three years.

The Pennsylvania lines are experimenting with a new track torpedo. Considerable trouble has been heretofore experienced by railroads in cases of wrecks, as the engineer and flagman very often differ widely in their accounts of just where the torpedoes had been placed on the track. The new torpedo is in the shape of a little tin box with wire clamps to fasten it to the rails. Underneath are two little circles of some red paste preparation, which, when the torpedo explodes, leaves a bright red stain on the rail, enabling officials to determine its exact location.—*Pittsburg Post.*

A compound engine of new design is being made for the North Eastern Railway of England at the Gateshead works. It is an old express engine built in 1893 as a two-cylinder compound, and is being rebuilt as a three-cylinder engine, with one inside high-pressure cylinder, 20 inches diameter by 26 inches stroke, and two outside low-pressure cylinders, each 19 inches diameter by 24 inches stroke. A boiler of large dimensions will be provided, having a firebox 8 feet long—an unusual size for a British locomotive. The working pressure is to be 220 pounds per square inch.

The Ingersoll-Sergeant Drill Co., of New York, have issued catalog number 32 of air compressors. This is a 96 page book of standard size and in addition to describing their compressors, gives considerable valuable information about compressed air. Railroad men who are using air pumps in shops should get a copy immediately.

After the war, there will undoubtedly be a wide field for the machinery and other trades in Cuba, and those who begin to prepare for it will reap the harvest. There is no doubt that one of the cheapest methods is to secure correct translations of the merits of your goods into the language of the island, and much depends on its being entirely correct. The Tejada & Sainz Company, of 49 East Ninety-ninth street, New York, are making a specialty of this work, and as we know them to be reliable and thoroughly acquainted with this work, we would recommend that our advertisers communicate with them.

The private car of the president of the Florida East Coast Railway, while not remarkable for ostentation externally, is one of the handsomest cars inside, that educated taste could suggest for quiet elegance. The observation room and staterooms are finished in satin wood and white mahogany, and dining room and kitchen in oak. A happy and homelike idea is worked out in the grate, which has a gas log for Pintsch gas. The trimming of the grate and mantel, and also of the toilet stands, is of onyx marble, than which no material could be used in those places with finer effect.

The Standard Pneumatic Tool Company, of Chicago, are sending out a cute photograph representing their "Little Giant" tools. A bright lad of five or six is shown, equipped with two revolvers, a bowie knife and a good supply of ammunition, holding in each hand one of their tools.

LOCOMOTIVE ENGINEERING
A PRACTICAL JOURNAL of RAILWAY MOTIVE POWER AND ROLLING STOCK.

Vol. XI. NEW YORK, SEPTEMBER, 1898. No. 9.

A North British Flyer.

Through the courtesy of Mr. Sam. A. Forbes, we show the new North British express locomotives, designed and built by Mr. Holmes, the locomotive superintendent of the road.

Until recently these trains have been hauled with practically the engines designed by Mr. D. Drummond in 1876, but the increasing weight of rolling stock necessitated heavier engines. The leading dimensions of these business-like looking locomotives are:

Cylinders—18¼ x 26 inches.

Drivers—6 feet 6 inches.

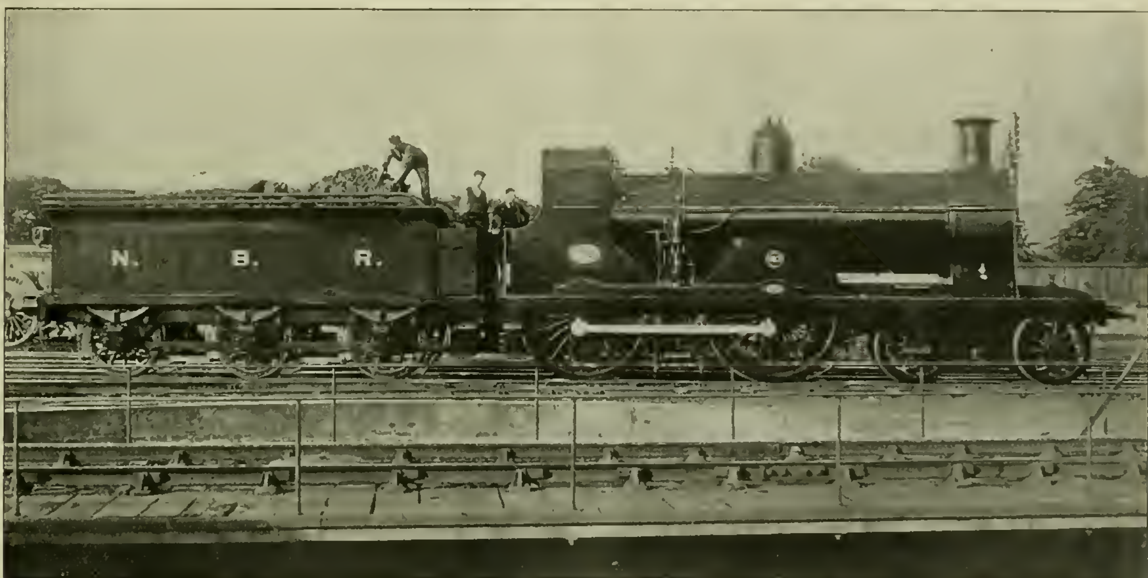
Boiler—252 tubes, 1¾ inches diameter. These give 1,224 square feet of heating surface, and with 126 in firebox, the total is 1,350 square feet.

They carry 175 pounds pressure.

The tender holds 3,500 Imperial gallons, or 4,200 United States gallons.

Engine and tender together in working order weigh 190,400 pounds.

Altogether they have a pleasing appearance (unless we except the customary lack of cab) and seem likely to give a good account of themselves.



A NEW NORTH BRITISH FLYER.

Crossing the Atlantic.

[EDITORIAL CORRESPONDENCE.]

After being over seven days on board the White Star steamer Britannic, we are approaching the Irish coast, and it seems to be in order to tell the many readers of LOCOMOTIVE ENGINEERING who have never "gone down to the sea in ships" what they may expect to go through if they ever cross the Atlantic.

This is what is now considered a small and slow boat. By taking certain other steamers the time of the voyage may be shortened two days and the furnishings will be found much more elaborate; but if a person is not in a great hurry and loves comfort, I should advise him to take the Britannic or some of the other boats that have been built more for the ease and comfort of travelers than for getting them across in the least possible time. I have tried both ways, and can give the advice of experience.

A very fast ship is nearly always disagreeable in a variety of ways. The enormous power used for driving the vessel makes the whole structure vibrate in a most disagreeable manner; in rough weather fast vessels tumble about while rushing through the rough seas, and the passengers hardly get settled down to enjoy the voyage when it is over.

This ship is a good illustration of the progress made in shipbuilding in the last thirty-five years since compound engines were introduced. When John Elder, of Glasgow, first introduced marine compound engines, the old simple types were using about 6 pounds of coal per horse power per hour. By improvements in proportions and designs of engines this expenditure of coal was gradually reduced till the year 1874, when the Britannic was built. The engines put into this vessel were of the tandem type, two pairs of cylinders being used, the high-pressure cylinder on the top, the low-pressure cylinder below. There was a good deal of prejudice against this form of marine engine, those put into the City of Rome having been of this type, and they proved a monumental failure. Not so these. They made a speed of 16 knots an hour on a coal expenditure of 1.75 pounds per horse-power per hour, and have kept this up for 24½ years. The quadruple expansions now used in late built ships give a horse-power on about 1.1 pounds of coal per hour. The boilers of the Britannic carry only 70 pounds gage steam pressure, while the latest practice calls for 200 pounds and over.

A passenger steamer is a small world in itself, and the people on board have to be housed, fed and cared for as in other communities, and an observer soon notices the different entities follow their affinities and form small subdivisions or cliques, just as they do in larger worlds. We are hardly away from the dock when divisions are being formed by the grouping of deck chairs, those who wish to keep themselves by themselves forming exclusive circles. Those who have affinities for the games or the refreshments of the smoking room get together and are seldom seen far apart. The same thing happens with those who like to play deck games, but the people who are known as saloon passengers are decidedly aristocratic and do not like to talk to people without an introduction. The only breaking of the barriers on the upper deck is when a passenger gets sick and gazes over the side with woeful spasms. Then all on deck are ready to condole with the sufferer. It really looks, though, as if some of the people enjoy the torments endured by those who are sea-sick.

The first time I was ever sea-sick was on a steamboat excursion out to sea. When we started the weather was fine, but soon a brisk breeze sprang up and a choppy sea tossed the boat about. Presently the women began to get sick, and the men were not long behind them. A fellow railroad man who was with me was intensely delighted with the sights and laughed heartily at every new case. After he had enjoyed himself immensely for about half an hour he suddenly made a dive for the rail and joined the feeders of the fishes. Before we got back he was lying in the scuppers praying that the boat might go down to end his agony.

People in the steerage are not so bound down by appearances as the saloon passengers, but sing and dance and enjoy themselves as freely as if there were no social distinctions. So far as having a good time is concerned, the steerage passengers are decidedly ahead of the people who dine in the saloon.

The ship that carries us is of 5,004 tons burden, and is driven by engines that develop about 5,000 horse-power. The Britannic entered service in 1874, and this is the two hundred and fifty-seventh round trip she has made. In all those long journeys, each about 3,000 knots, she never met with an accident. The total length of all the journeys is a little over 2,040,000 miles. The passengers on this voyage are 165 saloon, 450 steerage, and there are 150 people composing the crew. This passenger list is smaller than usual, for during the 24½ years the vessel has been running she has carried about 68,000 saloon and 192,000 steerage passengers.

A very important duty in connection with a passenger steamer is feeding the people. They are very much like an army in regard to food. If they are well fed they will be happy, contented and brave; if the food is unsatisfactory, all kind of savage passions will be evoked, and all the bravery displayed will be in abusing the heads of the commissariat department.

This boat was so well provided with necessities and luxuries of life that its world was happy. There was no grumbling to be heard about the table, which is a very unusual thing among a crowd of people who have little else to do than find fault. The feeding of the people during a round trip uses up about 16,447 pounds of fresh beef, 1,269 pounds of corned beef, 3,027 pounds of mutton, 1,200 pounds of pork, 573 pounds of veal, 346 pounds of fowl, 460 pounds of chicken, 120 pounds of duck, 552 pounds of game; fresh fish, 952 pounds; potatoes, 12 tons; 7,240 eggs, 64 barrels of flour, 2,000 pounds of sugar, 170 pounds of tea, 450 pounds of coffee and 1,200 pounds of butter.

Provisions for a long voyage are much more easily kept in good condition than they were only a few years ago. When attempts were first made to keep perishable foods for weeks without danger of spoiling, ice was employed in various ways to keep the storage room temperature low. What might be called the "ice-box" plan was tried first, but the cold was not evenly distributed. As an improvement, the ice was kept in one chamber, and a blast of air used to circulate its cold rays all through the store room. That was not entirely satisfactory, and the next move ahead was mixing the ice with a refrigerating liquid and forcing the mixture to circulate through pipes that were coiled in the room where the meat was kept. That plan was abandoned for mechanical refrigeration, which is now universally used in ships where large quantities of meat are carried. This system was developed in connection with the ships employed carrying dead meat from Australia to Great Britain, and is now in good working order. There were many failures at first, but these are now very rare, although extraordinary mechanical difficulties have to be overcome all the time. The principle of mechanical refrigeration is the compressing of a suitable gas to liquid condition, carrying off the heat of compression, and then permitting the gas to expand in pipes where it causes a freezing temperature.

In the Britannic they use carbonic acid gas as the freezing medium. The day I visited the refrigerating plant the gage showed that the pump was compressing the gas to 74 atmospheres—that is, 1,087.8 pounds per square inch, the pressure required to liquefy the gas

If the sea water were always cold, running a refrigerating plant would be an easy matter, but heated Gulf currents cause trouble. When we passed through the Gulf Stream this voyage the water was about 75 degrees Fahr. The chief engineer told me that on a previous trip this season the water was 81 degrees Fahr. No wonder that we have had unusually hot weather in the Northern States.

Rise of temperature makes carbonic acid gas harder to liquefy. At the freezing point it liquefies at a pressure of 36 atmospheres, or 540 pounds; while at 86 degrees Fahr. it requires a pressure of 72 atmospheres, or 1,290 pounds to the square inch, before liquefaction takes place.

Care of the refrigerating plant is the hardest duty that a marine engineer has to perform to-day. This one, like nearly all other passenger ships, carries many tons of fresh meat as cargo. A failure of the refrigerating plant means the loss or serious damage of the whole of the perishable goods on board.

People who travel in railroad trains in luxurious ease seldom think about the hard work, anxiety and exposure gone through by the men who are producing the motive power in the locomotive in front. It is the same with sea-going passengers. While lounging on the snow-white deck or sleeping in their comfortable beds, they are scarcely aware that a small army of men are toiling in the lower strata to keep up the steady throb of the engines that keep the ship forging ahead with unabated speed.

The motive power of the Britannic is manned by six engineers, one boiler-maker, five greasers, two refrigerator attendants, twenty-one firemen, eighteen coal trimmers, two storekeepers and one winchman. There are eight double-ended boilers having in all thirty-two furnaces, which burn about 110 tons of coal a day. The engineers and firemen keep watches of four hours on and eight off. Each fireman fires about 5 tons of coal per day, but merely throwing the coal into the furnace is a small part of his work, as slicing and forcing the fires has to be kept up all the time.

In closing this letter I wish to bear testimony to the rigid cleanliness and perfected discipline which prevail. I have failed to notice the least disagreeable odor in any part, although I have been all over the vessel. Once a day a bugle is sounded and certain men rush to the water-tight compartments and close the doors. The captain appears to spend all his time on the bridge. I have not seen him in the saloon or on deck. A. S.

Some of the master mechanics and traveling engineers who think beyond next week, are of the opinion that, on the very large freight engines at least, it may be advisable to employ an extra fireman to assist the regular fireman, and also help to watch signals.

The Grand Trunk's "999."

This is a very powerful engine, even for these days, with its 20 x 26-inch cylinders and 200 pounds working pressure.

The total weight in working order is 165,990 pounds, of which 124,990 pounds are on drivers.

The steam ports are rather large, 1⅝ x 20 inches, with 5½ inches greatest valve travel, 1 inch outside lap, ⅛ inch inside clearance, and valves set 1-16 inch blind in full gear, with ¼-inch lead at 6-inch cut-off in forward stroke.

Driving journals are 9½ x 12 inches, with main crank pin 6½ x 6 inches.

The boiler is 62 inches at first ring; thickness varies from 21-32 to ½ inch. Horizontal seams are butt joint, sextuple riveted, with welt strip inside and out; circumferential seams, double riveted. The crown staying is radial, with 1⅛-inch stays.

There are 291 tubes, 2 inches in diameter, giving 2,269.63 square feet heating surface, and a total heating surface of 2,740.63 square feet; grate surface, 33.44 square feet.

The tender carries 4,500 gallons and 20,000 pounds of coal.

Piston rods and valve stems are packed with U. S. Metallic Packing Company's packing.

There are three 3-inch Coale safety valves, one muffled, two encased; Detroit triple sight-feed lubricator, with Tippett device.

American outside equalized brake on all drivers. Westinghouse automatic air brake for engine, tender and train; 9½-inch air pump, also air signal. Houston pneumatic sander is used in sand box. A 6-inch Crosby chime whistle and two Ashton steam gages about complete the equipment.

It is stated over 90 per cent. of the parts of this and other standard engines built by this company (the Schenectady Locomotive Works) are interchangeable.

In the Navy.

BY W. DE SANNO.

While looking over a late number of Locomotive Engineering, I noticed mention being made of the U. S. S. New Ironsides, in quoting the ballistic force of the old smooth-bore guns. As I had the honor of serving on the above historical ship, no doubt an article on man-of-war life may interest some of the readers of the greatest railroad paper extant.

In this article I may talk to men who know more about the subject than I do; at the same time there are those who do not know anything outside of railroading.

Along in '60 I became ambitious to be an engineer in the navy; like the tinsel of the circus, the gold lace of the navy took a strong hold on my fancy. My maternal grandfather was a privateersman in 1812, and was one of the Dartmoor prisoners. My elder brother was in the navy on the coast of Africa and in the Mexican war; and myself spending a great deal of my boyhood days at the naval rendezvous in Philadelphia, I was decidedly webfooted. I started to post up; but, like all things done in a hurry, my studies were not thorough; at all events I applied for examination, and was ordered before the board at Brooklyn Navy Yard. The board consisted of Chief Engineers Shock, Garvin and Whipple. Yes, they "bilged" me on mensuration; and right here I may say, it was a well-known fact that a man who could "pass the board" while the late W. H. Shock was president of the board, had to be up to the standard. And that was all right, as it is safe to say the old navy produced better engineers than the "academy" is turning out to-day.

Perhaps if I had not passed so much of my time, while in school, drawing locomotives and ships on my slate, and in trying to make life a burden for the boy sitting next to me (poor boy; he has been blind for forty years), I might have passed all right. At all events I was determined to go to sea, and wanting to pick out my ship, I tried the Powhatan, then at Philadelphia, but it was no go.

The only chance for me was to go to the naval rendezvous and ship for general service, which I did as a second-class fireman; and was sent on board the Guardo, with my bag, hammock, tin pot, pan and spoon; a full-fledged Yankee tar—more tar than gold lace. The New Ironsides being about ready for sea, I was drafted for her; she required a force of fifty firemen and coal-passers. The late Harmen Newall was our chief engineer; one of our assistant engineers was the late N. B. Littig, who was afterward acting chief of the Oneida, and was lost on her in Japan since the war. My being a machinist secured me the rating of oiler soon after we went to sea, and I served as such on her during the operations in and around Charleston harbor. It was during the attack on Fort Sumter and the batteries in and around the harbor that we were directly over an old boiler charged with 800 pounds of powder. This toy was planted for the especial purpose to "hist" the Ironsides and was connected by wires with a battery on shore. I have since read statements from the man who was manipulating the wires, that the thing would not go off when they wanted it to. I might add that if the wires had worked all right, some other fellow would have to tell you about it, as there were five hundred of us who would never have had our names on the pension rolls.

Now I am not writing the naval history of the rebellion, and am only telling some things of a personal character, experiences, etc. In the next article I will go into details as to the duties, risks and disagreeable part of the engine and fire-room force.

THE GRAND TRUNK'S "999."

Another Oldtime Engineer, Julius B. Hawley.

Through the kindness of one of our readers, Mr. John Benedict, we are able to show one of the oldest engineers in New England. The house, too deserves mention, as it was built before the revolution, and is still standing in Stepney, Conn.

Mr. Julius B. Hawley is now in his eighty-first year. In 1839 he worked with the civil engineers laying out the Housatonic road, from Bridgeport to New Milford, Conn., the first in that section.

This section was finished in February, 1840, and a free excursion train run, which smashed several legs and arms, owing to the cars running away when uncoupled.

Mr. Hawley was one of the firemen on the first engine (for they had two at that time on this road); Hank Kimball was the other.

MR. JULIUS B. HAWLEY.

He also helped construct the line from Bridgeport to New York, and ran the first train between these points, on December 26, 1848. Two days later he ran the first train from New York to New Haven, which was the beginning of what is now one of our most important roads.

Mr. Hawley tells how once, on the old Housatonic, in about 1842, he was snowbound for three days at the upper end of the line, and no one knew where he was till he got back. The telegraph and telephone weren't used in those days.

Mr. Hawley, his brother, Abel W. Hawley, and his brothers-in-law, Joseph and John Clark, were all closely connected with the early history of the Housatonic and New Haven railroads.

These families date back so far in the history of New England that it seems as though they must have always been there, and the record of Mr. Joseph Clark in his application for membership in the Sons of the Revolution, could probably give heavy odds to most of them.

A newspaper, at the time he was dined at the Murray Hill Hotel by the officials of the road, relates this anecdote: "He was met in Bridgeport by ex-engineer Sam Rand and others, and on the way they built the road all over again, talking of old times. The first trainman who passed through the car was a brakeman, and Mr. Hawley offered his pass. 'That's the brakeman,' said Sam Rand.

"'Oh, is it; thought he must be the conductor, he had so many buttons.'

"When the actual conductor appeared, with gilt buttons and gold band on his cap, Mr. Hawley asked if it was President Clark.

"'No, it's the conductor,' Rand told him.

"'Gosh,' said Mr. Hawley, 'if that's the conductor, I'm afraid when I see the president I'll go blind.'"

The latest comer in the field of electrolytic reduction of refined copper is the Raritan Copper Works, of Perth Amboy, N. J., who are about to erect the largest copper refinery in the East. They have contracted with the Westinghouse Electric and Manufacturing Company for three 600 K. W., 150 volt, engine-type generators, 150 R. P. M., with a nine-section switchboard for electrolytic service, and the operation of two 75 K. W., 220 volt, engine-type generators, which will be used for lighting and power service. The installation will be the most complete of its kind in the world.

Fads and Fancies of Locomotive Building—No. 9.

This is a composite locomotive, being a cross between a Fairlie, Mason, Shaw and a few others, and not a whit better than either, if as good as the first two.

In the Mason of this type the drivers are grouped in a flexible truck which carries the cylinders. In this the cylinders and boiler are carried on the main frames separate from driving truck, the flexibility being obtained by making the drivers in a truck which can move in a different line from frame. The various levers, arms and wing-wongs are the compensating devices for taking up varying distances between pistons and cranks and for transmitting the power.

The excuse for this type of engine was that a powerful engine was needed for the heavy grades, and flexibility was necessary for the sharp curves.

In addition to the other contraptions, it is an eight-cylinder compound of the most complicated type, the low-pressure cylinders being outside and around the high-pressure cylinders—similar, as far as condensation goes, to putting them in a refrigerator. The high-pressure cylinders are 13 and low-pressure 28 inches in diameter by 24-inch stroke. Steam pressure, 180 pounds. Weight in working order, 130 tons.

Three of these were built by the Rhode Island Locomotive Works, from designs of Mr. F. W. Johnstone, superintendent of machinery of the Mexican Central Railroad. The design is certainly very ingenious, but it is an awful affliction for any locomotive to carry around—when it runs.

One of our friends was visiting the roundhouse a few years ago, and had hoped to ride on one of the curiosities. So he asked a man who was working on one of them when she went out next. The man looked all around to see who was near, and finally said, "When the directors meet again," which indicates they are not a howling success.

The St. Louis Railway Club held its June meeting aboard of a steamer by courtesy of the Wiggins Ferry Company, on which occasion business was combined with pleasure in a way entirely novel to club work. The paper read before the club at that meeting was entitled "Recent Improvements in St. Louis Ferries,'" and the management of the above ferry company did a very graceful thing in extending their hospitalities to the club on its consideration of a subject directly in touch with their business. Aside from the refreshments served, the opportunities given the members to inspect the different railway lines entering St. Louis on both sides of the "Father of Waters," made the June meeting a day that the club will not soon forget.

FADS AND FANCIES IN LOCOMOTIVE BUILDING—No. 9.
THE "JOHNSTONE," MEXICAN CENTRAL RAILWAY, 1891.

Peculiar Locomotives.

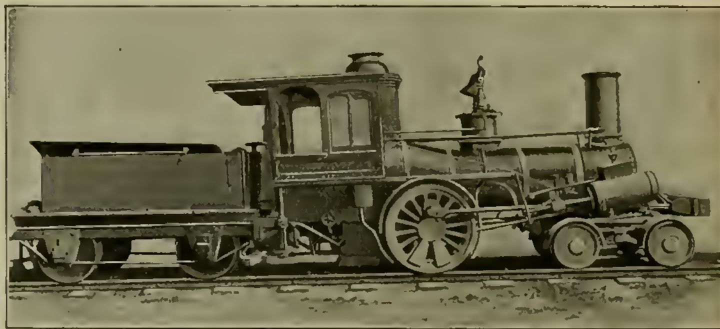
Our friend Mr. Henry C. Frazer, inspector for Westinghouse Air-Brake Company at San Francisco, Cal., sends us photographs of two old-timers he finds on the Pacific slope. They are the property of the Oakland Nail Works, Oakland, Cal., and have not been used since the mills burnt down, about five years ago. He says:

"The engine with the single pair of driving wheels was built by M. W. Baldwin, at Philadelphia, some time in the forties. The writer of this remembers this engine as far back as 1854. The engine was then running on a little railroad in Lancaster County, Pa., which was called the Strasburg Railroad, and was about four miles long, connecting Strasburg with Leaman Place, a station on the Pennsylvania Railroad. The name of the engine at that time was the 'William Penn.' It was quite a grade up to Strasburg, and the writer well remembers how they used to let her out on the main line of the Pennsylvania Railroad to get a run for the hill, with her little old four-wheel cars. Two was her train, and I have seen her come back lots of times to get another run for the hill, or the 'bank,' as our English friends would say. At that time she had an old balloon stack, two pumps, an old square sand box and a very dilapidated cab.

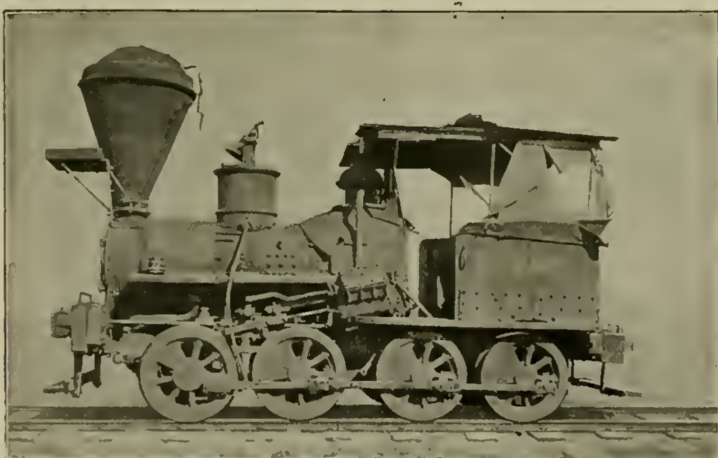
"In 1865 the writer was an apprentice in the Norris Locomotive Works, at Lancaster, Pa. Edward Norris bought this engine at that time. The Baldwin firm had built a new engine for this road. 'William Penn' was brought to Lancaster and rebuilt. The driving wheels were made solid at that time—about the only change that was made on her. The engine had the old 'V-hook' motion, and it is still on her. In January, 1886, this engine was shipped around the 'Horn' along with six eight-wheelers for the Western Pacific Railroad. This road is now part of the Southern Pacific system.

"When the writer came to California, in 1881, this engine was used to do the switching around the Sacramento car shop. In 1883 she was in the 'bone yard.'

"About 1885 she was rebuilt, about $800 worth of work done on her, and sold to the Oakland Nail Works for $1,000. Mr. A. J. Stevens, then S. M. P. and M. of the Southern Pacific, took off the old square sand box and put on the present one with the bell on top of it; also put on a new cab, injector on left side, but left the balloon stack on. The straight stack was put on by the nail company, and, by the way, it is large enough for a 22-inch cylinder. The name was changed to the 'Dude.' About one year ago this engine was fired up and moved about the yard. The smoke arch door has on it: 'Rebuilt by Ed. Norris, 1865, Lancaster, Pa.'



AN OLD NORRIS—"WILLIAM PENN."



A NONDESCRIPT.

"I cannot give you any history of the other engine. I rather think, however, that it was built by some San Francisco firm, a few years ago—probably the Union Iron Works or the Risdon Works. As the engine has the link motion, it is more than likely that it is not very old. It is four-wheel connected; the cylinders are back at the firebox and the main rods work on cranks that are fastened to a shaft running under the smoke arch. This shaft has a gear on it, and this in turn works into a large gear fastened on the forward axle. Two middle pair of drivers have blind tires. The reverse lever is fulcrumed above the quadrant, consequently the quadrant is U-shaped. There are two checks, but no way of feeding boiler. I think it more than likely there were injectors on at one time. The engine was never of much use at the Nail Works, as the wheel-base is too long for the short curves in the yard."

Railroad Men Are Not Tramps from Choice.

Mr. J. H. Goodyear, who has been doing some quiet investigating along this line, has looked up the facts concerning the men who have applied for work, and the results are briefly summed up as follows. These figures demonstrate:

First—By the percentage of Americans, that the men tramping the country are not foreigners.

Second—The average age, that they are not men who have outlived their usefulness as locomotive engineers.

Third—The average hight and weight, that they are physically fit.

Fourth—Percentage of those married, that they are not tramp engineers from choice.

Fifth—The general average showing length of service with the first railway, also the great percentage of men having worked for but one road with such a good average service as 10 years 8 months; that there is something radically wrong with the present system of handling enginemen.

This is food for thought for all those who have charge of men, and it is to be hoped that some practical remedy may be devised. It will be better for all concerned. Mr. Goodyear's deductions appeared in the *Railway Age*.

In speaking of the horseless carriage, in the June issue, we neglected to give the full name of Mr. Weiss, and several letters of inquiry from those who saw the article have been wandering over the country trying to find the right man. Letters addressed to Mr. Geo. L. Weiss, Cleveland, O., will reach the right party and bring information about this interesting vehicle.

Texas & Pacific Ten-Wheeler.

Rogers Locomotive Company have just completed one of the ten engines they are building for the Texas & Pacific Railroad. They are ten-wheel freight engines, as shown, have 19 by 24-inch cylinders, 57-inch drivers and carry 190 pounds of steam.

Some of the specifications follow:

Weight on driver, 98,000 pounds.

Total weight, 130,000 pounds.

Firebox, 33⅜ by 102 3-16 inches.

Tank capacity, water, 4,500 gallons.

Tank capacity, coal, 12,000 pounds.

The brakes are Westinghouse-American, bell ringers and packings are of United States Metallic Packing Company's make; injectors, two No. 8 Monitors; Gould automatic couplers, Coale's muffled safety valve, Houston's double sander. Star steam gages, Nathan No. 9 triple lubricator. Tires are partly Latrobe and partly Standard Steel Company. They have Pyle electric headlights.

a dollar for a show at the bill of fare and then see how much you can eat for your money.

One of the very enjoyable features of this train is the library. Shortly after the train starts, a porter delivers to each person a printed list of the books on hand—about one hundred—giving title and author's name. Passengers select books from the list, the porter brings them, and they can be kept during entire trip if wanted. I noticed that every woman on the train patronized this library, as did most of the men.

The engines used make the time easily, although it is fast for the country traversed. Engines that pull this train at night are equipped with electric headlights.

Electric fans are used in dining cars, which keeps them cool without opening windows and admitting dust.

This limited train is limited only in name. It costs nothing extra to ride on it.

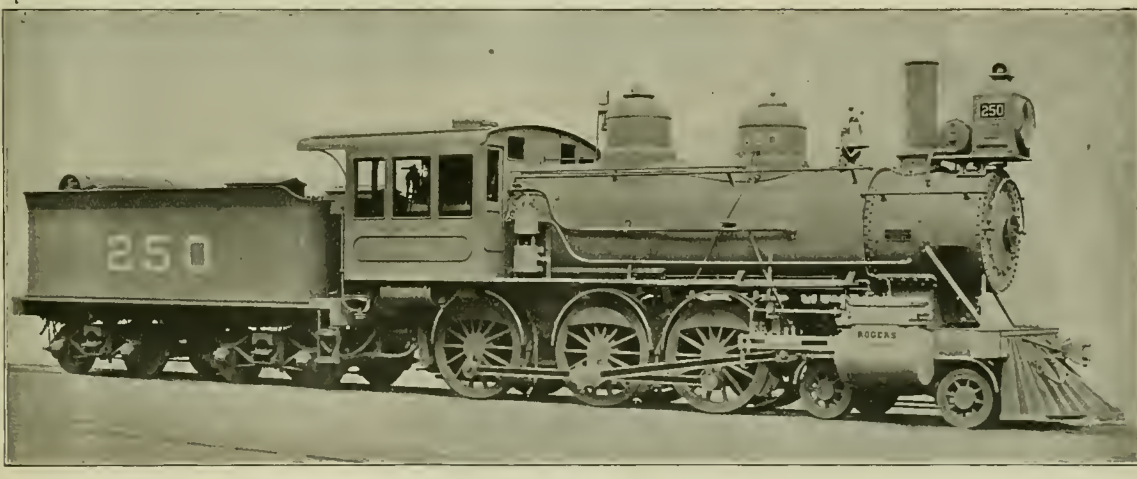
The Birthplace of Railroads.

"When I was office boy for the Housatonic road in 1847," said Mr. Joseph Clark, "we had a little office over a jewelry store in Bridgeport, and the civil engineers who were running the line used to come in to report and make plans.

"One day they sent me out for a map of the United States, and after studying it over, Col. R. B. Mason stuck his compasses in Chicago and swept a circle on the map. 'It's the center of the country,' he said, 'and the coming railroad center.'

"They drew lines radiating from Chicago and forming what proved to be the starting of the Illinois Central, Lake Shore & Milwaukee and what is now the Chicago, Rock Island and Pacific. These men were instrumental in building them, and Col. Mason was afterwards Mayor of Chicago."

This indicates that there are always men who can grasp an opportunity when it is offered. These men get to the front.



TEN-WHEELER FOR TEXAS & PACIFIC RAILWAY.

"The Rocky Mountain Limited."

The above name has been given by the Rock Island road to a train they have put on this season, running from Chicago to Denver, 1,082 miles, in twenty-eight hours.

To those of us who crossed the plains in the seventies, with two and a half days *via* the K. P. from Kansas City to Denver, it seems a long step in advance to be able to leave Chicago at 4.30 P. M. one day and be in Denver the next evening at 8 o'clock.

On a recent trip the writer had the satisfaction of traveling *via* this train. The train itself is all that can be asked, new sleepers, without smoking compartments; a separate smoking car with wicker chairs and leather upholstery for mankind's comfort, and a dining-car service that is beyond criticism—one of the kind where you order what you want, eat it like a civilized human being and pay for it. The other kind is where you pay

It does only a long-haul business, however. With it the Rock Island people have removed all the dread of crossing the plains. Oh! the plains are fast disappearing, and from Omaha to Denver is a vast green pasture, where it is not a corn or wheat field. Given a fast train over good tracks, no anxiety about meals, plenty of time to eat and enjoy, and a good book, and where are the plains?

I was in Africa all the way across the plains. Haggard and I were just naturally licking whole impis of Zulus, by contract, to say nothing of side shows of other smaller tribes that we finished off with knob-kerries while resting.

I got separated from H. Rider in the last fight and found myself confronting old Chetoway himself. He grinned, lowered his war club, leaned toward me and said: "We're three miles from Denver, sah!" and then he hit me a swipe with a brush-broom. I didn't see any plains.

J. A. H.

A Good Record.

The following letter from Mr. Geo. E. Kennedy, S. M. P. of the Oeste de Minas Railway, Brazil, speaks highly of the wearing qualities of the engine referred to. Some of the details of the engine follow the letter.

S. Joao d El-Rey, June 17, 1898.

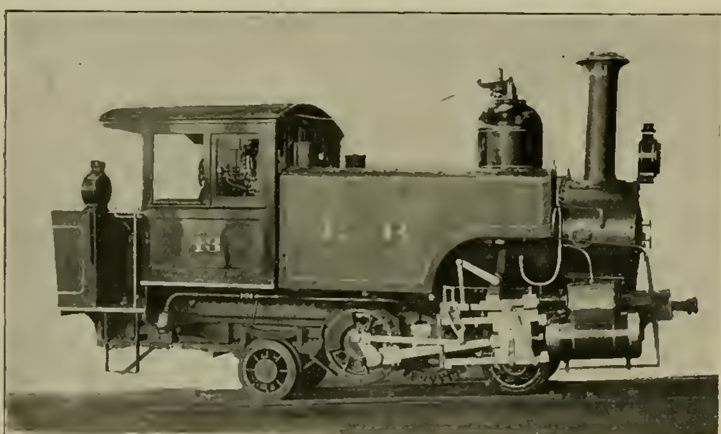
Ao Snr. S. M. Vauclain, Baldwin Locomotive Works, Philadelphia, Pa.:

Dear Sir—Enclosed you will find an account of kilometers run by engine No. 35 from the date of mounting until taken in for thorough repairs. She commenced running in May, 1895, the trial trip taking place on the 9th, and in July, 1896, we held her in for a slight repair—truck wheels turned, new brasses in boxes, new cylinder packing, metal on crossheads and a few other small jobs—and then went on the train again and ran until September, 1897, when the truck was taken out and a spare one put under, new wheels in tender and other small repairs done. Left low-pressure piston rod broke in April, 1898. New rod and cover were put on, and she ran until we held her in on the 13th of June. To arrive at the actual number run on the train, deduct 10 per cent. from the total, which we allow monthly for shunting, etc. The driving wheels were never touched nor wheels taken out. On taking the diameter of wheels before entering the lathe, I found the smallest 36¼ inches, being ¾-inch wear. The directors and general manager are very pleased with the engine. I have been fifteen years in Brazil and have not seen a narrow-gage engine beat this performance.

KILOMETERS RUN BY ENGINE NO. 35, FROM BEING MOUNTED UNTIL TAKEN IN FOR THOROUGH REPAIRS.

	1895.	1896.	1897.	1898.
January.....		3.638	3.912	4.510
February ...		3 278	3 339	4.835
March		4,140	4.096	6.265
April........		3,148	4.423	4.963
May........	2,008	4.096	4.164	5.654
June........	3.647	5.610	3.674	1,647
July	3.737	1.296	3.471	
August	4,182	3 428	4,439	
September ..	3,328	3.533	2,488	
October	4.637	4,914	5,016	
November...	3.361	3.740	4,888	
December...	4,384	4.294	5,915	
Total......	29.284	45.115	49,825	27,874

This makes a total of 152,089 kilometers (94,301 miles) in thirty-eight months of service.



RACK LOCOMOTIVE FOR BRAZIL.

The locomotive referred to is an eight-wheel American type with Vauclain compound cylinders.

Gage of track—76 centimeters (2 feet 6 inches).

Cylinders—7 and 12 x 16 inches.

Drivers—Diameter, 37 inches.

Boiler—Wagon-top, 40 inches.

Number of tubes—118, 1¾ inches.

Firebox—38⅞ inches long, 31⅞ inches wide.

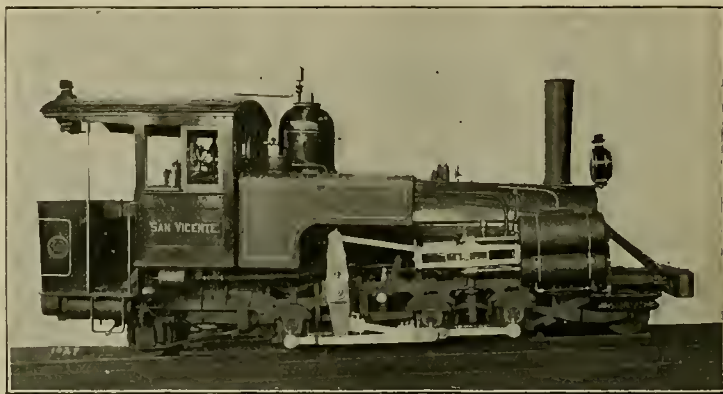
Total wheel-base—18 feet 2½ inches.

Driving wheel-base—7 feet 4 inches.

Total weight, working order—43,000 pounds.

Total weight on driving wheels—25,000 pounds.

Tender tank capacity—1,200 gallons.



A MOUNTAIN CLIMBER FOR MEXICO.

Two Climbers.

These are climbers for mountain roads and are interesting on account of their difference from usual engines. The Leopoldina Railway of Brazil is a rack road of 3 feet 3⅜ inches gage. The cylinders are 13 by 20 inches, Walschaert valve gear, and the diameter of drawing gear at pitch line is a trifle over 41 inches. It weighs 54,500 pounds in working order.

The other is for a Mexican road, and has six driving wheels in addition to the rack wheel. The drivers are 25¾ inches, and the pitch diameter of gear 22½, nearly.

The cylinders are 9 and 15 by 22 inches. The gage is 2 feet 6 inches, total wheel base 19 feet 5⅜ inches. Total weight, 58,480 pounds, on drivers 40,750.

The frames are inside the wheels, counterbalanced cranks being outside.

Power is transmitted through a walking beam arrangement, as on the Pike's Peak locomotives. The front truck equalizer occupies a prominent position in the photograph. They are Baldwins.

The necessity of eternal vigilance and care in the inspection of switches has again been forced on the attention of road masters, by the killing of three men—the engineer and fireman and another engineer, who was deadheading at the time, by the derailment of the engine. The failure of a switch to go to position when the signalman pulled the lever, was the cause of this loss of life, besides the injuring of five others. A defective switch rod or bolt is understood to be the cause of this disaster, and occurring as it has, on a road justly noted for its splendid corps of permanent way officers, only emphasizes the fact that the best of precautions are none too good to avert trouble at switches, more especially those operated at a distance, where it is impossible for the man at the lever to know whether his work is right or wrong until too late.

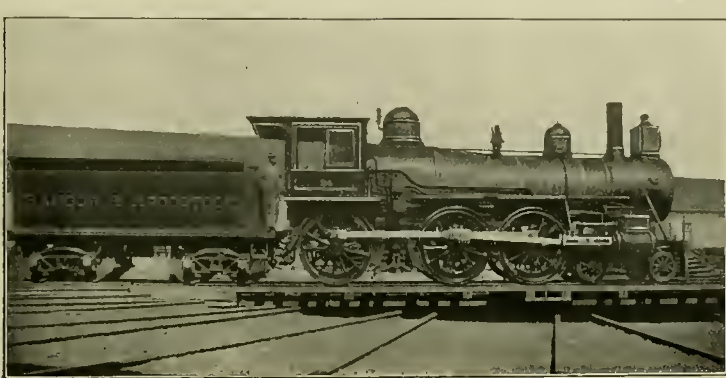
The blacksmith shop of the Baltimore & Ohio at Mount Clare is one of the few shops of the kind in which there are no stacks or hoods for the forges—all are open, and the remarkable thing about it is the absolute absence of smoke in the shop at all times. There are no exhaust appliances to produce this effect; all gases simply pass through a well-ventilated lantern by natural processes. Besides the freedom from smoke, the shop is one of the neatest in all respects. If there is any connection between a clean shop and an incentive to do work, it would seem to crop out in the output of over 200,000 pounds of forgings per month for the car department alone. The greater part of this work is made of rattled scrap, and it therefore represents a large pile of it, and implies work for the shears in cutting it up.

Low Cost of Repairs.

Our friend, O. M. Stewart, superintendent of motive power on the Bangor & Aroostook, sends us a photograph of one of their ten-wheel engines, which has has made a splendid record in low cost for repairs.

During the year ending June 30, 1898, engine 25, just like engraving, ran 71,296 miles, with a total cost of repairs of $664.55, or .93 of a cent per mile run.

Of the thirty-two engines, the one shown made the highest mileage by over 10,000 miles, and though two engines show a lower cost per mile for repairs, they both made less than half the mileage this one did. When an engine is averaging nearly 6,000 miles a month on a cost of less than a cent a mile for repairs, the power is costing very little money in this respect. Although it is "way down East," as Mr. Stewart expresses it, it is a very creditable performance for any railroad.



THIS ENGINE COST LESS THAN A CENT A MILE FOR REPAIRS LAST YEAR.

Engineer Brown's Problem.

There's a romantic story in several chapters being carried on near the main line of the Santa Fé, between Topeka and Emporia, and if all the facts were known, some people would be surprised. There's a certain engineer whom we will call Brown for convenience; his engine will be No. 47 for the same purpose. Brown has been in the habit of making a visit when he stopped to whistle for a certain railroad crossing. He would stop, pull the whistle, jump to the ground and a romantic young girl would appear from the shadow of the tree and allow herself to be gathered in her future protector's arms, while a shower of kisses would be rained upon her upturned face. It would all take but a minute, and Brown would clamber back into his engine cab and pull out.

This has been going on for some time, and the fireman has become so accustomed to it that he would reach over, open the throttle and get the engine started as the engineer would climb back upon the seat in the cab. One night Engineer Brown was absent from the run and another engineer took his place. When the crossing was reached, the new engineer stopped and whistled and saw a woman emerge from the shadow of the tree.

"What's that?" he asked of the fireman.

"Why, it's Brown's girl waiting to be kissed," replied the fireman, and he explained to the engineer all about it.

"Well," said the new man on the run, "I guess I can kiss her as well as Brown," and he climbed down out of the cab, and after the fireman had heard several loud explosions from the outside the engineer came clambering back to the cab, chuckling to himself.

Engineer Brown was absent from the run for several days, and when the girl asked him how it came that he had a mustache one night and none the next night and then a mustache again, the story came out, and now Engineer Brown is trying to figure out how many of the engineers on the line have been kissing his sweetheart.—*Topeka State Journal.*

Aluminum Reducing Wheel.

Indicating locomotives is not by any means such a common practice as with stationary engines, and appliances have not been developed as in the latter case. The use of a reducing wheel for reducing motion between crosshead and indicator, is common enough in stationary work, but not in locomotive practice, and we show one in use on an engine of the Cincinnati, New Orleans & Texas Pacific Railway, commonly known as the Cincinnati Southern Railway.

It was used in some tests made by Prof. F. Paul Anderson, of the State College of Kentucky, who was assisted in the work by two of the students.

The device requires little explanation, the arm from crosshead being connected to a cord on large diameter of wheel while the indicator cord proper goes from small diameter to indicator drum. One advantage is that the cord may run in any direction in the same plane, for being always tangent to wheel, the motion is not affected.

This device is made by the Webster & Perks Tool Company, of Springfield, O.

The Commissioner-General for the United States to the Paris Exposition of 1900, Mr. Ferdinand W. Peck, sends us translations of the rules and regulations and the classifications, and urges the earliest possible selection of space of American exhibitors, as the time is limited.

ALUMINUM REDUCING WHEEL FOR LOCOMOTIVES.

The *Railway Magazine*, of London, illustrates a locomotive called "Old Coppernob," which is claimed to be the oldest locomotive still in service. It was built in 1846 and is in use on the Furness Railway. Its cylinders are 14 by 24 inches, and its four drivers 4 feet 9 inches in diameter. There are no truck wheels.

How to Lay Out a Locomotive Boiler—Method of Laying Out the Throat Sheet and Upper One-half of Connection.

BY HENRY J. RAPS.

Fig. 6 is the front elevation of the right one-half of throat sheet.

Fig. 7 is a sectional view on the line *A C*, Fig. 6. Fig. 8 is a side elevation.

To lay out the plate for throat sheet, draw at right angles with one another the lines *A B* and *B C*, Fig. 9; 20¼ inches from the line *B C*, and parallel with it draw the line *D E*, which represents one-half of the width of lower part of sheet after flanging.

At Fig. 7 the inner radius of flange is 2½ inches. As the sheet is ½ inch thick, the outer radius is 3 inches. Draw the line *F G*, Fig. 9, 3 inches from the line *D E* and parallel with it.

As the radius of center of flange is 2¾ inches, we have for the circumference of quadrant $2\frac{3}{4} \times 3.1416 \div 2 = 4\ 5\text{-}16$ inches. Draw the line *H I*, Fig. 9, 4 5-16 inches from the line *F G* and parallel with it.

The width of the flange at Fig. 7 is 7⅛ inches minus the radius of flange, or 3 inches equals 4⅛ inches or the width of straight part of flange.

Parallel with the line *H I*, Fig. 9. and 4⅛ inches from it, draw the line *A i*. At right angles with *A i* and 51½ inches from the line *A B*, draw the line *i J*, which represents the total length of sheet. From *i* to *J* mark off the width of the wing, in this case 13¾ inches; draw the line *J K* at right angles with *i J*.

From *B* to *L* mark off the hight of sheet at center after flanging, in this case 28⅝ in. With *C* as center and radius *C L* (which is 28 5-16 inches) draw the arc *L M*. From *L* to *N* mark off the outer radius of flange, which is 3 inches, and describe the arc *N O*. From *N* to *a* mark off the circumference of the quadrant, which is 4 5-16 inches, and draw the arc *a b*.

As the total width of flange at this point at Fig. 8 is 7⅛ inches, we have for the straight part 7⅛ minus the outer radius equals 7⅛ — 3 = 4⅛ inches. As the sheet will stretch at this point in flanging, we will add ⅛ inch, making this dimension 4¼ inches. Make the distance from *a* to *c*, Fig. 9, 4¼ inches and draw the arc *c K*. Locate the points *d* and *e* 7 inches from the point *K* and draw the arc *d e*, locating the center of the arc 2¼ inches from the point *K*. Locate the point *x* 2½ inches from the line *A i* and 2 inches from the line *i J*, and draw the line *x J*. Make the distance from *A* to *Y* equal to the distance from *E* to *O* and draw the line *X Y*. Locate the staybolt rivet and washout holes, completing the laying out of sheet.

METHOD OF LAYING OUT THE UPPER ONE-HALF OF CONNECTION SHEET.

Fig. 1 is a side elevation. The part to be laid out is enclosed by the lines *A B*, *B C*, *C D* and *D A*, the flange and lap to be added. The distance from *B* to *A* and

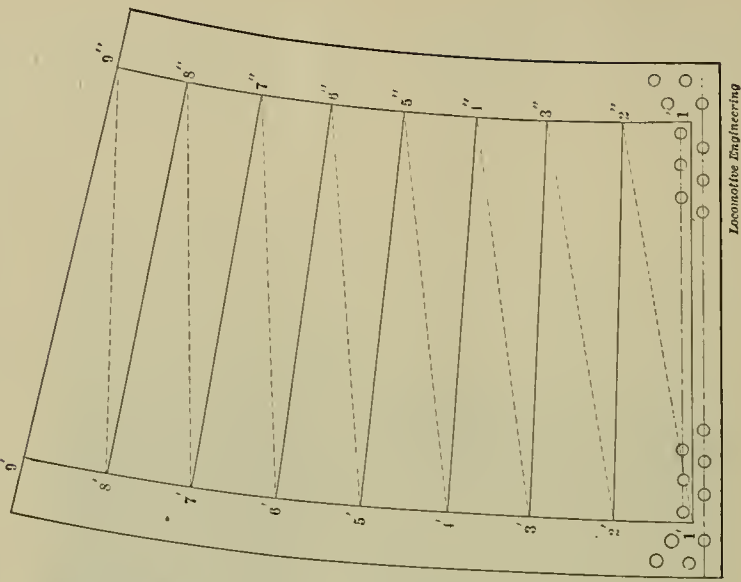


Fig. 5

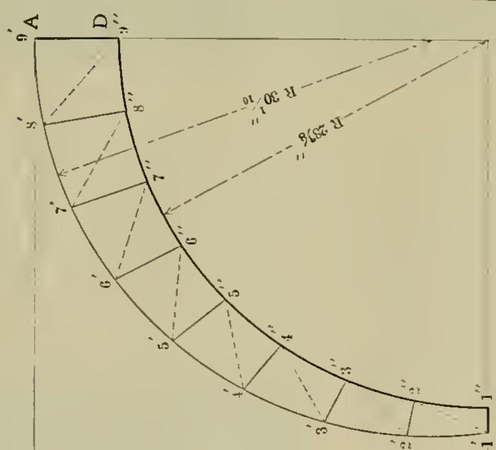


Fig. 2

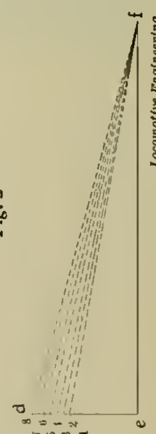


Fig. 4

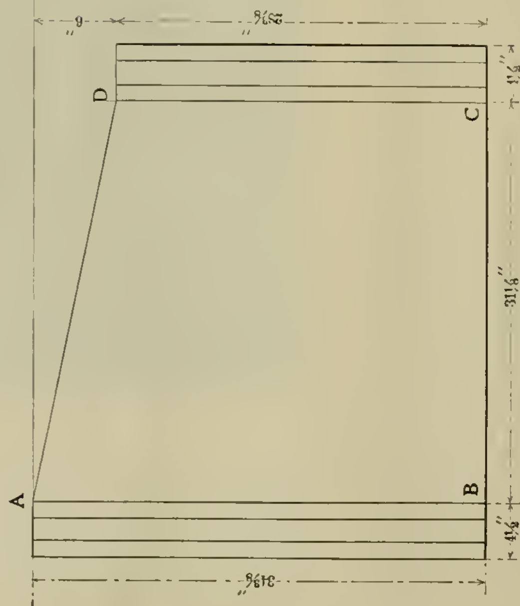


Fig. 1

Fig. 3

from *C* to *D* is taken from the center of the shell to the center of the thickness of connection at the top.

Fig. 2 is an end elevation of one-half of the piece to be laid out.

Divide the quadrants *A B* and *C D*, Fig. 2, into any number of equal parts—in this case eight.

Draw dotted lines from points 1′ to 2″, 2′ to 3″, 3′ to 4″, etc. Connect the points 2′ and 2″, 3′ and 3″, 4′ and 4″, by solid lines.

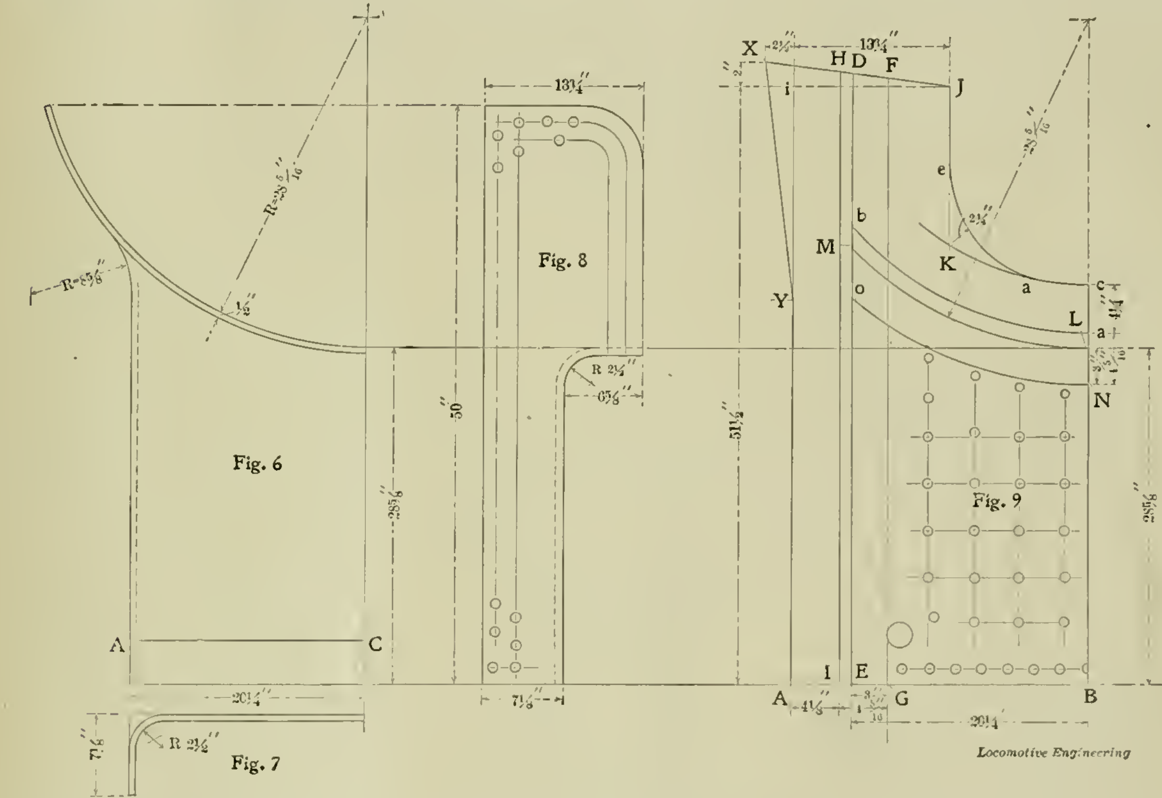
Draw the triangles shown at Figs. 3 and 4, making the perpendiculars, or the 2″ 3″, Fig. 5, equal 2″ 3″, Fig. 2, and 2′ 3″, Fig. 5, equal *f*2, Fig. 4, and draw the dotted line 2′ 3″, Fig. 5.

Make 2′ 3′, Fig. 5, equal to 2′ 3′, Fig. 2, and draw the solid line 3′ 3″, Fig. 5.

Proceed in the same manner with the balance of the plate. A line drawn through the points 1′ to 9′ and 1″ to 9″ will complete the outline of one-half of the plate; lap and flange to be added.

Should there be a double row of rivets in straight seam, one row should be laid out above the line 1′ 1″, Fig. 5, and the other below.

taken out of the hands of the men. A knowledge of hardness or otherwise of the stone, or, indeed, of speeds for same, does not enter into the question; it is simply one of knowing when to true it up that we have to deal with. That is the point that all seem weak on, they evidently don't want to know when it is time to get a true face on it. The same old feeling governs to-day as at the period when we were doing time as a cub. It was the rule in that shop that the apprentices should take turn about at turning off the grindstone. On one occasion



lines *b c* and *e f*, equal in length to the line *B C*, Fig. 1. Make the bases of the triangles on the line *a b*, Fig. 3, correspond with the solid lines drawn across Fig. 2, making, *b*1, *b*2, *b*3, etc., Fig. 3, equal in length to 1′ 1″, 2′ 2″ and 3′ 3″, etc., of Fig. 2. Connect the points *c*1, *c*2, *c*3, etc., of Fig. 3, by solid lines.

Make the bases of triangles on the line *d e*, Fig. 4, correspond in length with the dotted lines drawn across Fig. 2, making *e*1, *e*2 and *e*3, etc., of Fig. 4, equal to 1′ 2″, 2′ 3″, 3′ 4″, etc., of Fig. 2. Connect the points *f*1, *f*2, *f*3, etc., by dotted lines.

To lay out the plate, draw the line 1′ 1″, Fig. 5, making it equal in length to *c*1, Fig. 3. Make 1″ 2″, Fig. 5, equal in length to 1″ 2″, Fig. 2, and 1′ 2″, Fig. 5, equal in length to *f*1, Fig. 4; draw the dotted line 1′ 2″, Fig. 5. Make 1′ 2′, Fig. 5, equal in length to 1′ 2′, Fig. 2, and draw the solid line 2′ 2″, Fig. 5. Make

The Shop Grindstone.

Since the day when "Chordal" gave us that accurate picture of the shop grindstone with its rugged and furrowed face, surrounded by fiends with the one purpose of making it worse, there has been very little improvement in the care of that necessity of every machine shop. The advent of emery wheels rather aggravated the situation than otherwise, for the reason that the latter takes the attention of the better class of workmen, and thus leaves the stone to the care of those that have no interest in its well-being, and it is allowed to make its patient cycles until the flanges appear flush with the cutting face, and even above it.

It is one of the things that no one has yet explained, that a shop having no other loopholes for fair criticism will almost invariably go down on the grindstone question, and that, too, in one case we know of, where all tool grinding is

when our Saturday arrived to do the truing act, we laid off to go to a funeral or something, and each succeeding Saturday some one of the other fellows had a like duty to attend to; the meanwhile the old stone was losing money for the company at every revolution. Our turn came again, and we had to true up one of the worst cases of grindstone it was ever our misfortune to look at, and all on account of our misdirected diplomacy. It was such a laborious job that we have been forever disgusted with the sight of a stone that don't run true. There was no laying off thereafter to avoid a disagreeable duty—the foreman learned the combination and broke it up. The efforts of the cubs to avoid the job had the effect of introducing an automatic truing device in that shop, and the old gas-pipe tool for truing was laid away forever, as it should be, in every shop where apprentices are expected to use it.

Tool for Turning Sharp Flanges.

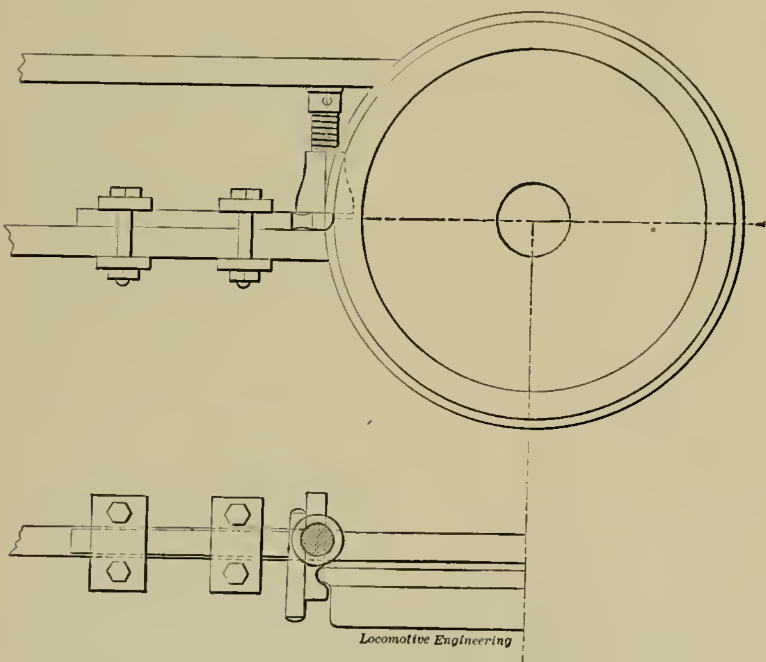
Many attempts have been made, from time to time, to turn off sharp flanges without taking the wheels from under engine.

Failure has been due to several causes—principally, we believe, because of too elaborate fixtures and the attempt to turn tire while engine was in service, scraping off a little at a time.

The device here shown is in use at the Salida, Col., shops of the Denver & Rio Grande road, and was built by General Foreman Owen Owens. The clamps for lower rail of frame are very heavy, and the tool is held down by an ordinary screw jack. The end of the clamped piece is beveled just enough across the end to compensate for the taper of a main rod key, which serves to force the tool up to its work.

When the tool is set, the engine is pulled backward, on straight track, by another engine, and the wedge is driven up so as to insure a cut.

No trouble is experienced in properly shaping up a sharp flange in from fifteen to thirty minutes.



TOOL FOR TURNING SHARP FLANGES.

Link Motion Models.

The makers of the Locomotive Link Motion Model have advanced prices to us so that we are compelled to make the price $75 instead of $60 as heretofore. We have recently filled an order at the old price to avoid disappointing our friends, but cannot do so in future. Just note that it costs $75 from now on.

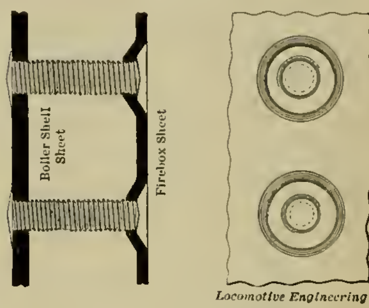
An Improvement in Side Sheets.

Most motive-power men have had their share of trouble from leaky side sheets. They know that weeping staybolts means a constantly increasing cause of trouble until there are cracks enough to demand a new sheet. This trouble commences, and is confined almost entirely to that part of the sheet actually in contact with the fire.

In ordinary practice the staybolts are riveted up on the inside enough to upset the bolt in the hole—this puts a strain on the sheet around each bolt. The action of the fire on the bolt tends to heat it to a higher temperature than that of the sheet around it—less water to keep it cool. When cooling off there is a difference in the contraction between the sheet and the bolt—hence the usual cracking between bolts.

On the Rock Island road they are using "cupped" or depressed sheets, which several years of service show a cure for the troubles enumerated above. The side sheets are cupped under a punch before the holes are punched out, the depression usually being equal to the thickness of the sheet. When the staybolt is riveted up in this depression, there is not the same tendency to rupture the sheet as with a straight sheet. The head of the bolt is back from the fire, and there is enough elasticity in the plate—due to the cupping—to allow the sheet and bolt to follow each other when contracting and expanding. The bolt heads and depression around them are found to coat over with soot, showing that the action of the fire is not so intense there as on more exposed part of sheet.

The Rock Island have over a hundred engines thus equipped, giving the best of satisfaction—some of them in use over three years. In the early stages of the experiment, Superintendent of Motive Power Wilson had one engine turned out with one cupped and one plain sheet for trial. The cupped sheet is still in service, giving no trouble, while the other sheet has long ago been replaced.



CUPPED SIDE SHEETS.

The Big Four road are also using this device, we are told, with good results.

Our advice to master mechanics subject to this kind of grief would be, to try the cupped sheets. The cost of cupping is from $3 to $5 over cost of ordinary straight sheets—a very small sum compared with the cost of "tinkering" side sheets.

Those interested should correspond with Mr. Wilson for further information. We believe the scheme is patented.

The lively export trade indulged in by our locomotive builders continues to hold up to the pace set, without any near prospect of a falling off in orders. A recent award of contracts for China and Russia has evidently stirred up the English builders to renewed efforts to put their plants in a condition for competition with the American locomotive manufacturer. To this end enlargements and increased facilities for meeting the requirements of short-time orders are under way, with the idea of reclaiming some of the trade diverted this way. This will be successfully done, we believe, in a very small measure only; for once established, the balance of trade is likely to remain in our favor.

When it comes to enthusiasm and persuasiveness it is hard to beat a railroad man. The other day Lieut. Hobson, of Merrimac fame, went to Glen Ridge, N. J., to pay his respects to Mrs. Sampson, but he couldn't remain in obscurity. Engineer Locke recognized him and insisted that he ride with him in the cab, and he did, thanking Locke for the privilege. When he got back to Hoboken, he found flags arched to receive him and an appropriate motto. He won't forget the railroaders for some time.

Practical Letters from Practical Men.

All letters in this Department must have name of author attached.

Saving Oil at Expense of Coal—Engine Repairs.

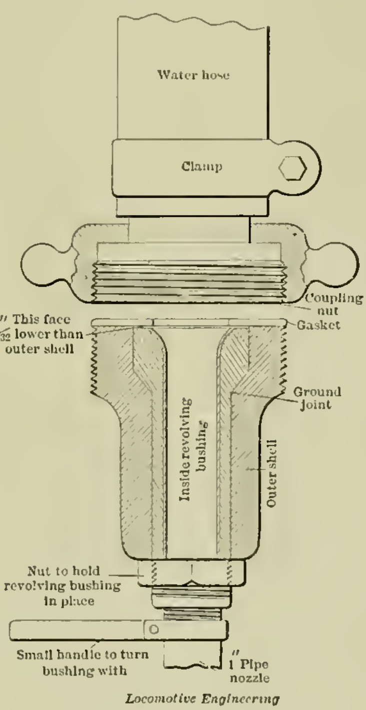
Editors:

An article in the May issue of LOCOMOTIVE ENGINEERING on "The Abuse of Engine Oil," written by Mr. J. S. Patterson, of Cincinnati, O., will no doubt attract the attention and no little comment from the reading and thinking railway men of the country. I say thinking men, for men in the locomotive departments of this country, unlike soldiers in the armies, have the undisputed right to think, and should think hard on questions pertaining to the use of oil and coal. While, as one of our generals in the army once said, "A good soldier has no right to think; his only right is to obey orders, let the result be what it may," I am glad railway men are not like soldiers in this one respect, for thought on the handling of locomotives and the use of oil and coal to the best advantage, is essential to the success of all railroads.

Mr. Patterson, in referring to the performance of engines on oil, on the Houston & Texas Central Railway, as shown by the superintendent of motive power and machinery of that road, seems to advocate the same theory as the war general, in regard to men running engines. He says, "In the writer's opinion, there is not to-day a locomotive engineer, nor those who ran engines before the flood, that knows just how many miles or how far they can run a locomotive with one pint of oil." Let this be as it may, it would be a poor man indeed who could not tell how far he ought to run to the pint of oil, being governed by the weight and speed of train. Mr. Patterson, while doting on the oil records made by engineers on the Houston & Texas Central Railway, might just as well have said (for he would not have been doubted any quicker by practical men), that, in his opinion, there is not an engineer running an engine to-day that knows just how far he can haul a train of a given weight, with a tank holding 3,000 gallons of water and carrying six tons of coal; or that a practical engineer could not make the time on a forty-mile schedule without the aid of an indicator in front of him to tell just what speed he was making while train was in motion. An engineer who cannot do these things is not "master of the locomotive." Skill is the result of practice, and good judgment is essential in the proper handling of a locomotive. Economy of oil and coal and good wear on machinery are the results of skill and good judgment put into practice.

At this day and date, when seniority and not merit rules on most roads, all who sit on the right side of locomotives are not competent to make oil records and save coal, which represent, to a great extent, the company's money. Engineers competent to save money by saving oil and fuel and protract the wear of engines by proper handling are, however, the rule. Like men at the head of our locomotive and other departments, good engineers are "born such," and polished by strict application to duty and hard study.

Mr. Patterson further says, "The slushing of oil into a pair of cylinders that are mechanically out of shape, by engineers



BOILER WASHER NOZZLE.

that carry more water in the smokestack than in the boiler, will not cure the defects." Defects of this nature are the direct results of incompetency. Why run cylinders that are mechanically out of shape? This is encouraging incompetency and aiding extravagance. Why put men in charge of engines who carry water in smokestack instead of boiler, thereby killing the steaming power?

How often have we seen engines just out of the back shop, with cylinders newly bored out, put mechanically out of shape the first fifty miles they are run—the result of not getting sufficient oil to fill up pores in the iron left open by tool marks? This is one place where the slushing of oil spoken off by Mr. Patterson would be an advantage for the first twenty-five or fifty miles.

The mileage plan of lubricating locomotives is a good plan. But is it a correct plan, as applied to most roads, or the most economical plan, as to the amount of coal used per mile? Will some theorist who thinks the miles run to the pint of oil are unlimited please tell us what the relative effects on the wear of machinery and the consumption of fuel are, compared to the cost of each? The old rule of so many cars for a certain class of engines, regardless of contents, was a train; to-day it is so many tons to a certain class of engines, regardless of cars; therefore the lubricating of engines by the tonnage plan would be a more correct plan than the mileage plan. All practical locomotive men will agree that the higher the rate of speed attained and the heavier the train, the greater the degree of friction to be overcome by oil. An engine running twenty miles per hour with light train will not necessarily use as much oil as an engine running fifty miles per hour with heavy train.

Usually when valves, valve yokes and eccentric straps and rocker arms break, it is directly caused by insufficient lubrication.

Making a good showing on oil—that is, one that is too good for the coal bin—and losing sight of the wear on machinery and cost of running repairs on engines, is a matter that can be indulged in too freely for the best interests of the stockholders.

GEO. E. BRADFORD.

Covington, Ky.

Connection for Boiler Washer Nozzle.

Editors:

I send you a sketch for boiler washers, hose and nozzle connection, which allows the free use of nozzle without the labor of twisting hose around. It also obviates the necessity of leaving coupling free to turn and getting wet all over. This arrangement makes a tight joint and allows the nozzle to turn free and easy. I give it to LOCOMOTIVE ENGINEERING for others to see and use. It is easy to make and not expensive.

A. J. EDMONDS,
Roundhouse Foreman.

Mason City, Ia.

Little devices like the above increase the amount of work done as well as the comfort of the men.

Relief Valve in Dry Pipe.

Editors:

It has been suggested to the writer that the proper place for the ordinary relief valves so commonly used is not in the steam chests, but in direct connection with the dry pipe, one valve of proper dimensions being used instead of two. Fig. 1 shows a form of the idea, in which *V* is a pipe screwed into the stand pipe *U*, and passing by a suitable stuffing box through the back boiler head, with the relief valve *W* on the outer end.

The advantages claimed are, that when steam is shut off the air is drawn through the hot boiler and dry pipe, thus having its temperature raised to a degree that avoids chilling the chests and cylinders, and thereby causing undue condensation when the steam is again admitted; that less dirt and dust are drawn in to cut the wearing surfaces, and that a neater and simpler effect is obtained, together with stronger chests and greater freedom from leakage. Is this idea new or old, and if ever tried, with what results? Let some of the readers of LOCOMOTIVE ENGINEERING express their opinions.

FRED E. ROGERS.

Corning, N. Y.

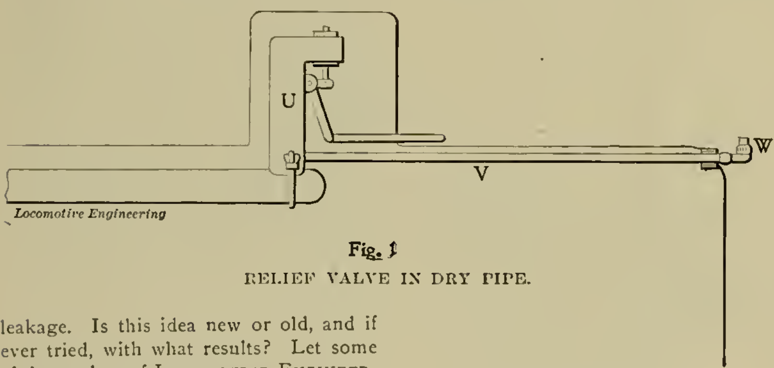


Fig. 1
RELIEF VALVE IN DRY PIPE.

Get the Bottlejack.

Editors:

Seeing in the LOCOMOTIVE ENGINEERING of April an amusing incident of the mechanic's mate who was told to get the maul, and took the order to get them all, called to my mind a case similar, where one of our mechanics told his mate (whose name was Jack, and a new beginner) to get a bottlejack. Jack off with all haste, and after a diligent search up and down the drain amongst the grass he came back with a pint and a half bottle. His mate, like Homer, not being the best tempered man in the world, you may guess the result at seeing his mate with a bottle to make a lift with, especially as it was empty. Had it been full of its original contents it may have smoothed matters.

D. H. STEWART.

Penrith, N. S. W.

Practical men have practical ideas which may help others. Send us yours, and sign your name.

Lubricating Iron and Steel Axles.

Editors:

The requirement of fast and heavy traffic on roads of the present, and the successful handling of same, should produce a careful supervision of material used in all journals of locomotives and cars. We have had extensive trials of steel to replace iron in axles, pins, pistons, etc., and while successful in a general way, there have been serious objections to its general use caused by hot journals. Steel in either axles or pins will run very well with a brass bearing of soft, tough brass, with or without babbitt, and with hard brass babbitted or tinned, but gives very poor satisfaction with hard or brittle brass alone.

Iron journals give best results with hard, tough brass, but will run very successfully with any ordinary composition of dense or fine-grained brass. The nature of iron being fibrous, it conforms more readily to its bearing, and it is found that the dark substance adhering to an iron journal is somewhat of a lubricant.

Steel is of a crystalline nature, and, being hard, it is much more difficult to come to a perfect bearing, and is more liable to heat. When heated it is much more difficult to cool than iron. While being an advocate of steel where it can be used, I believe iron gives the best results for journals. Both metals have many features in common.

A steel pin breaks at the same point an iron one does, likewise an axle, and it will be found in most cases that the broken pin has at some time been hot. The heating of a pin to any great extent is a serious cause for thought. Being pressed in the wheel very tight, that part of wheel fit is held or compressed to its size, and the part of journal is free to expand with heat. This causes an uneven strain on metal at the hub or separating point of expansion. While this may be very little, still it affects the life of metals.

The different natures of steel and iron can be observed in turning pins or axles. Iron will show a clean, clear shaving from tool, but with steel you will see the shaving brittle, snappy, and often a spark and explosion from tool caused by bursting globules of the metal. In lubrication, which is a closely watched expense at present, the iron will absorb a percentage of oil to its surface, or the fibrous nature of it will allow the oil to retain its lubricating qualities to a better advantage than will the hard, denser metal of steel, which has no affinity of retaining any substance like oil to its surface. With the proper composition of brass in bearing and iron journals, the oil question is easily solved.

J. J. FLYNN.

Louisville, Ky.

High or Low Steam.

Editors:

Doesn't it seem as though there was a little too much variation in railroad practice regarding steam pressure for the same work? Rather looks as though every new engine was an experiment and they want to go as high as they can. I've no objection to high-pressure steam in its right place; but is its right place on locomotives with simple cylinders?

In stationary practice they rarely use over 125 pounds of steam on simple engines, using compounds for higher pressure. In railroading we use simple engines with as high as 185 pounds pressure. Of course the two cases can hardly be compared, but I doubt if it is economy to use such high pressure in simple engines. They do more work, I hear someone say. Not always, although there is no doubt they are capable of doing it; but in many cases it isn't necessary, and the high pressure goes for naught.

On a road near here they have two classes of engines, the only difference being that one has 5½-foot wheels and carries 140 pounds; the others were 6-foot wheels and carry 180 pounds. The fast runs are given to the last named; but when for any reason they are not available, one of the "140-pounders" is hooked on and makes the time all right. The boys say the big ones do it easier, and probably they do; but the little ones do it on time and cost less for repairs.

Of the "180-pounders" there were eleven patches put on ten boilers within a year, while the lower pressure engines have no trouble of this kind.

Another feature is that the waste of heat with high pressure steam is greater as the exhaust is at higher pressure. With compounds this objection is removed. It seems to me, when all the objections are considered, that the high pressures (over 140) are not warranted for simple engines.

If the engines are not powerful enough at 140 pounds, give them a little larger cylinder (either diameter or stroke). The boiler will probably be large enough as it is.

R. E. MARKS.

Camden, N. J.

Caught in His Own Net.

Editors:

Years ago when traveling engineers and road foremen of engines were quite rare on Western railroads, Cal Redding was appointed to the latter position.

Mr. Cal wasn't noted among his fellows as being especially equipped for the position, to judge from his general reputation as a locomotive engineer, and the "pull" which secured him his advancement was more or less obscure. However, he assumed the duties and immediately showed his hand, to the amusement of the enginemen and his own discomfiture.

Cal had been running an old Manchester originally built for a wood-burner, and as a consequence the firebox door opening was of very liberal proportions. It was a well-known fact that the "432" broke her own coal readily—that is, if the aperture behind the door was large enough to receive it—and no objections were ever advanced by Cal at Fireman George Sykes' negligence to more frequently manipulate the coal pick. Contrary to Cal's practice as an engineer, he made it a special point as road foreman to impress upon the firemen the importance of breaking the coal reasonably fine as an economic factor.

A few days after his accession to his new duties, he happened to be at a way station, when along came the "432," dragging a heavy freight train. He got aboard, mounted George's seat and sat ready to impart any information or directions which might be required for the good of the service. Here was Fireman Sykes' opportunity. He clambered up the coal pile, slid down several of the largest chunks in sight, then returned to the cab. Placing the largest on the shovel, he gave the door a vigorous swing open, and, bracing himself, swung the shovel, and into the firebox went the huge piece of coal. Again he reached for another, and just as he was about to raise it from the tender, Cal, in a voice of thunder, shouted, "Hold on there, George; what the d——l are you doing?" "Oh," said Sykes, calmly, in reply, "firing her the same as I used to for you."

The moral deduction to be drawn from the above is, if you ever expect to be a road foreman of engines, be careful as an engineer to look after the company's business on your engine properly, and thereby avoid a possible pitfall such as Cal had inadvertently dug for himself.

S. J. KIDDER.

Chicago, Ill.

Injector Feed Connection.

Editors:

Your articles on Injectors interested me, and I wish to suggest the feed connection or strainer shown in your November issue, 1896, as superior to anything I know of. Hose strainers are continually giving trouble. This was the invention of Mr. C. Linstrom, of Vicksburg, Miss.

It is also noted by those using these pipes that the peculiar noise made by injectors at work is lessened very much by these pipes, still leaving enough noise for the engineer to know that his injector is working satisfactorily.

M. J. DONOVAN.

Vicksburg, Miss.

Value of Babbitt.

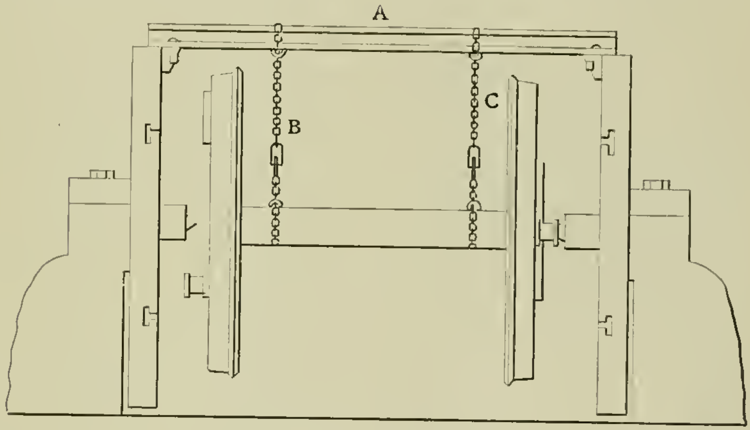
Editors:

I note on page 405 of your August number an extract from a London paper, that reads rather strangely. It alludes to a short article of mine on Anti-friction Alloys, published on page 220 of the May number. This was an addition I sent in with the proofs of my letter on Babbitt, that appeared in your March number; there being then, however, no extra space available for it, it was held over for a while. The paragraph on page 405, after the first three lines, merely reproduces what I wrote on page 220. What are the reasons the trade journal alludes to? I am well aware there are plenty, on both sides.

Have been asked what threepenny-bits are. A threepenny piece is a small silver coin, value threepence, or six cents.

H. ROLFE.

Scranton, Pa.



SUBSTITUTE FOR OVERHEAD CRANE.

A Substitute for an Overhead Crane.

Editors:

Some weeks ago, while in the Buffalo & Susquehanna shops, at Galeton, Pa., the rig shown in the sketch was seen for placing drivers in the wheel lathe. While it seems to be an old scheme, it was new to the writer, and possibly it may be novel to some of the readers of LOCOMOTIVE ENGINEERING. When one considers the amount of time and labor expended in some small shops that have no overhead facilities for getting wheels in and out of the lathes, it seems tha this simple rig would be more generally used.

As will be seen, the device consists of a piece of rail *A* bolted by angle pieces to the face plates, and over this and around the axle are hooked the two chains *B* and *C*. These chains are provided with turnbuckles, so that the length can be closely adjusted. When used, the wheels are rolled in front of the lathe, which has the face plates turned around till the section of rail is at about the same height as the axle, then the chains are hooked in place and the lathe started. The wheels are easily and quickly swung in place without fuss or trouble.

Some other interesting specialties were seen, one of which is a worm-driven boring bar capable of taking a cut through a 20 x 24-inch cylinder in one hour.

FRED E. ROGERS.

Corning, N. Y.

Recognizing the Engineer.

It's a good sign when the naval commanders, in writing their reports of the great fight off Santiago, mention the engineering force for their efficient service. Commander Wainwright, of the Gloucester, which did such daring work with the supposed terrors of the sea, says: "That we were able to close in with the destroyers was largely due to the skill and constant attention of Passed Assistant Engineer Geo. W. McElroy." He also recommends Robert P. Jennings, chief machinist, and says: "I believe it will have a good effect to recognize the skill of the men and the danger incurred by the engineers force." Several other commanders made similar mention, and the good feeling seems to be growing between the line and the engineering force. This is more like it. It has been too much the other way in the past, and if the war has brought about a recognition of the value of the engineering force, it is another good point accomplished by it.

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Reasons for Delay of Papers.

We receive each month a lot of notices from postmasters all over the country, notifying us that "Mr. John Jones' paper could not be delivered, as he had moved and left no address." Pretty soon we get a kick from John Jones to know why he hasn't got his paper.

We use every precaution possible to have the paper reach subscribers promptly, and spend considerable time and money in writing to club-raisers for the new addresses of their subscribers, after being notified by the postmasters. You can help us greatly by notifying us promptly of your change of address or a change of any of your club.

Instructing Firemen.

At the convention of the Traveling Engineers' Association, to be held at Buffalo this month, they are going to discuss the question, "How can the traveling engineer best instruct and assist firemen in the economical firing of locomotives?" We consider that this is one of the most important questions before locomotive men to-day. It has been a live subject ever since coal burning began, and it will excite keen attention as long as power for transportation purposes is generated by converting water into steam.

The fuel bill is one of the largest items of railroad expenditure, and a very small percentage of saving makes a material difference on the cost of train operating. On that account it is natural that railroad managers should keep persistently urging their subordinates to impress upon the fireman the necessity for doing his work in a way that will do the maximum of steam-making with the minimum of coal, and it naturally falls upon the traveling engineer to impress upon the fireman how this desirable end can be accomplished.

There is a tendency among many firemen to resent the interference of traveling engineers or others with their methods of doing the work of keeping up steam. They assume that if a fireman can "keep her hot" that he knows all that is necessary to be learned about firing. Men who look at their work from that standpoint have been born too late. The idea passed muster on many roads twenty years ago; it may be tolerated on a few roads to-day, but the kind of management which is indifferent to the work of the fireman are on the wane, and the brunt of keen competition will steadily root them out.

There is nothing so universally admired as skill, unless it may perhaps be courage. A first-class mechanic who can do a job better than any of his shopmates is always popular and has an admiring following, no matter what kind of a man he may be in other respects. We have met cowards and bullies who were despicable in every other way, who kept up a certain kind of personal popularity merely because they were exceptionally good workmen. With that sentiment rampant, we cannot understand why firemen should resent the help of the traveling engineer, or of any other person, to help them to become first-class workmen at their own calling.

The old style of training for firemen was the crudest and worst possible, since it was based on the hypothesis that a man strong enough to throw wood or coal into a firebox, at the rate needed to make steam, was good enough material for making a fireman. Without any previous training the young man was placed on a locomotive and allowed to train himself, through much tribulation, to keep up steam. We know of no other line of employment where the employers are so much interested in the quality of the work done as that performed by the fireman, or where so little attention has been bestowed upon training the workman. An inferior fireman wastes fuel away beyond the extent of his wages as compared with the first-class fireman who knows how to make every pound of coal do its best in steam making. Why then should not railroad officials do their best to make all their firemen first-class men?

An engineer has so much to do and so many important duties to attend to nowadays, that he has not the time to devote to the instruction of a new fireman. On this account a new fireman ought to go out under the instruction of a traveling fireman. A trip or two would be sufficient and the training given would be a good investment for the extra expense involved. After a fireman has got a little instruction in the elementary part of his art, the work of the traveling engineer ought to begin on further training of the man. This should consist of instruction regarding the principles of combustion and the best manner of firing certain engines and different kinds of coal.

No hard and fast rules can be laid down for the guidance of firemen, for the proportions of the engine, the arrangement of the draft appliances make very material difference on how the firing must be done to produce the best results. A rule becoming very common directs the fireman to fire in small quantities at a time and keep the body of the fire light. That will work well if all conditions are favorable, but a variety of things may prevent a light fire from being carried. Some kinds of coal cannot be burned to good advantage in a thin fire. When the grate area is restricted and the draft strong, it may be impracticable to make an engine steam freely with a thin fire, for the rush of air will lower the temperature of the fuel products. Certain engines with very large grate area cannot be operated with a very thin fire, because some part of the grate is always getting uncovered and letting cold air through that does not get heated to the igniting temperature and goes throug the tubes carrying away heat.

These are not arguments against the practice of firing often and carrying a light fire. They are merely explanations of why it may not be practicable sometimes to adhere to sound principles.

Firing in such a way that there will be no smoke emitted from the smoke-stack may be regarded as good practice, but it does not always follow that the fuel is being burned to the best advantage. A great many smoke-consuming furnaces have been invented which entirely prevented smoke, but it was always found that more fuel was used when smoke was entirely suppressed. This is contrary to laboratory tests, where the exact volume of air needed for combustion could be regulated to a nicety. With furnaces this cannot be done, and to keep the fire smokeless more air than what is necessary must be admitted. The heating of that extra air uses up more coal than the small quantity carried away as smoke when the air is more restricted, unless it is very thick indeed and carries a heavy mixture of unconsumed volatile gases. If it paid to operate furnaces without smoke, there would be no smoke nuisance to complain of in our manufacturing centers. It is because preventing smoke costs money that the chimneys of factories cloud the air with volumes of soot.

All these things ought to be taught to firemen, and the traveling engineer is the best man to impart this kind of practical instruction.

Protecting Cylinders from the Cold.

There are certain things happen in the course of every stroke of the steam engine's piston which investigators say are highly objectionable, and it goes without saying that when any engineering evil is needing a remedy, there will be plenty of men ready to provide it. One of the most wasteful things that are known in the cycle of an engine stroke is the condensation and re-evaporation of steam, and the attempts to stop the action or lessen its wastefulness have been legion. We have noticed lately proposals to revive the use of a steam jacket to prevent the evils referred to, and we may expect soon to hear of great savings being made by this invention, which is almost as old as the steam engine itself.

James Watt, of Scotland, who improved the crude pumping engine of Newcomen into an engine that could be applied to manufacturing purposes, discovered that a large proportion of the steam which passed from the boiler to the cylinders lost its vitality on the journey and entered the condenser in the form of water. It was already known that in the work of pushing the piston, the steam lost considerable heat, as the heat was converted into work; but there was found to be much more steam condensation in the course of the stroke than that due to the performance of work. Watt and other scientists found out that the metal of the cylinder acted as a condenser on the incoming steam, and converted a great part into water before it had the chance to do any work. The wise men who interested themselves in developing the steam engine on scientific lines concluded that a perfectly non-conducting material was necessary for the construction of steam-engine cylinders. They had no difficulty in convincing people that if cylinder surfaces did not take up or give forth heat, the steam that touched them would pass along without loss of heat. Now, said those wise men to engineers, find your non-conducting material and you will have no trouble from condensation of steam in the cylinders.

The engineers, accustomed to facing the problems of their work on common-sense grounds, did not spend any time looking after a perfect non-conducting material, a substance nature has not yet brought forth; so they tried to reach the same end by a feasible road. Watt believed that a steam-filled jacket surrounding the cylinder would do a great deal to prevent condensation, and he accordingly began building engines with this plan of cylinder protection, and other engine builders soon fell into the same practice. In the case of the big slow-moving engines, mostly used in those days, considerable saving resulted from the use of steam jackets; but when higher piston speeds became common, the utility of the jacket was questioned.

Various attempts have been made to protect the notoriously exposed cylinders of locomotives by steam jackets, but very little good has resulted. Locomotive cylinders ought to give better results from the use of steam jacket-protection than the cylinders of any other engine; but steam jackets on them have always been failures when subjected to the ordeal of regular service. Parties who have applied steam jackets to locomotive cylinders have repeatedly shown in tests that the saving effected ranged from 10 to 20 per cent. When engines that have been improved so much by the use of steam jackets have been kept in service a few months and then tested again, it was found that about the same percentage had gone to the loss side. Unless perfect means are employed for draining the water from a steam jacket, it becomes itself a condenser instead of a protection, and it is very difficult to keep the draining apparatus in perfect order under the hard knocks which a locomotive is subject to.

Many attempts have been made by American inventors to pass the gases from the fire around the cylinders to keep the latter hot. Rather promising results have been got in this way, but in a little while the gases deposited a gummy substance over the surface expected to be kept warm and the heat was not carried to the metal. Early English engineers held that the best way to protect the cylinders of locomotives from the chilling effect of the cold winds was to place them in the smoke-box, and this led to the use of inside connected engines. It is safe to say that the drawbacks of crank axles and other weakness of inside cylindered engines offsets all the benefits derived from the protection that the smoke-box gives to the cylinders.

It seems to us that if designers and builders of locomotives would provide for a good thick non-conducting covering for their cylinders, steam chests and cylinder saddles, they would save considerable steam and do the best thing possible to reduce the evils of cylinder condensation.

Adieu, Wootten Soft Coal Burner.

The burning of inferior coal refuse and coal slack in locomotives has been for years associated with the Wootten firebox. That form of firebox with its immense grate area and heating surface was regarded as the means by which the coal refuse hills thrown aside from all large coal pits would eventually be utilized for steam-making purposes. The proprietors of the Wootten patents made vigorous efforts for years to push the use of their firebox on roads using bituminous coal, and not a few locomotives were equipped with that firebox. The enginemen, as a rule, did not like the Wootten firebox, principally because it called for the cab being placed on top of the boiler. But the engines steamed so freely that the first prejudice soon wore off. The railroad officials were nearly all favorable to an improvement which promised to materially reduce their fuel account. Yet all that would not keep the engines long in service. They would get along fairly well for a few months, and then the repairs would become so great, the delays for firebox repairs so protracted, that the engines fell into disrepute and were eventually altered.

That was the experience of quite a number of railroads that tried to use Wootten fireboxes for burning bituminous slack. It has been long a surprise to us that the Philadelphia & Reading was alone able to use bituminous coal successfully in their Wootten fireboxes. The coal burned on that road was mostly anthracite slack, but in the last few years the market demand for that kind of coal has been so great that bituminous slack was purchased for the freight locomotives. Then the trouble began. Last month we mentioned that the Reading had ordered some new freight locomotives which will not have Wootten fireboxes. We are greatly mistaken if any more fireboxes of that kind will be made for freight engines.

We have not been able to learn the views of the officials as to why a Wootten firebox will not burn bituminous coal as successfully as it burns anthracite, but we will venture an opinion. The anthracite has no flame, and its combustion gives out a uniform heat that radiates evenly over the crown sheet and transmits fairly uniform heat intensity. The bituminous coal products of combustion, on the contrary, consist, to a great extent, of intensely hot tongues of flame that impinge upon the crown sheets with a melting temperature and induce such extremes of expansion and contraction that the metal soon becomes distorted and the staybolts weakened. If we are wrong in this conclusion, we would like to be corrected by readers who have had experience with these fireboxes burning soft coal.

American Coal the Best.

When any controversy is going on about the relative merits of American and British locomotives the statement is always made that the British locomotives deserve credit because they do their work with less consumption of coal than what is burned by American locomotives. The answer given to that argument always is, "Your coal is much superior to ours, which accounts for the difference in the quantity burned." That is generally accepted as a good explanation. We have recently discovered good reasons for believing that American locomotives on some lines burn coal which is superior to anything mined in Great Britain.

The steamship Britannic is slow for a liner, and is always supplied with the best coal to be found in Liverpool and in New York. At the former place she is supplied with the best Welsh coal, and at New York the bunkers are filled with Pocahontas coal. Long experience has proved that about one knot an hour more speed can be got out of the ship when Pocahontas coal is burned in the boilers than when Welsh coal is used. The difference results entirely from the Virginia coal making steam more freely than that mined in Wales.

Information about facts of this kind seems to spread very slowly, for the engineering world of the United States regards Welsh coal as the best in the world. The builders of fast torpedo boats in America have repeatedly sent to Wales for coal, to be used on trial trips where a knot or two extra of speed meant a high bonus. The likelihood is that they would have profited very much if they had been contented to use the best to be found at home.

Lignite Coal for Locomotives.

The vast beds of lignite lying in inexhaustible quantities in this country, incite renewed efforts periodically, looking to its use on locomotives. There are many reasons for this desire to harness the heat units lying dormant in this volatile stuff, the principal and controlling one being, of course, its cheapness, this figure being practically zero on some roads, the major portion of expense being embraced in haulage for those roads owning the mines—"mines," by the way in this connection, is only a figure of speech in most cases of reclaiming lignite for fuel, for the reason that it is so often found just under the earth's surface, and not very far under at that.

This imperfect formed coal is usually distinguished by its woody character and large percentage of moisture. It is lighter than coal, and having a low calorific value (about 10,000 heat units per pound), with rapid combustion when dry, is not a desirable fuel, save from the cost standpoint. A great many schemes have been tried in order to successfully burn lignite on road engines, the leading idea among these seeming to run in the grooves of large grate surface and a diamond stack; the first on account of quick burning, and the second to reduce the conflagration radius on the right of way.

No satisfactory firebox proportions have yet been found to burn this fuel exclusively, but it has been mixed with bituminous coal with a percentage of the latter high enough to enable the engine to get over the road, and pronounced all right under those conditions. But the retention of sparks with the diamond stack and best devised drafting arrangements, has been but indifferently realized, according to our best information, and it is not clear that pursuit of the subject can produce any economies worthy of the name, notwithstanding glowing reports to that effect.

BOOK NOTICES.

"Practice and Theory of the Injector." Strickland L. Kneass. John Wiley & Sons, New York. $1.50.

This is a revision and enlargement of the first edition, and the additions have added much to its value as a book for the practical man who is handling injectors. In Chapter IX we find a record of a complete test of a locomotive injector, giving a description of the apparatus and mode of procedure, so that anyone interested can make a similar test at any time.

A new chapter has been added which gives practical suggestions for determining the causes of failure to work properly, and tells how the troubles may be cured. Of course it is impossible to describe every cause of failure, as they are many, and elusive at times, but from this any mechanic can get hints that will enable him to locate almost any difficulty. From the view of the practical railroad man, the book has been greatly improved since the first edition.

PERSONAL.

Mr. John A. Zehner has been appointed division engineer on the Lehigh Valley, with office at Wilkesbarre, Pa.

Mr. F. W. Stanyan has been appointed superintendent of the Montpelier & Wells River, with office at Montpelier, Vt.

Mr. C. Shields has been elected president of the Columbia & Red Mountain, with headquarters at Spokane, Wash.

Mr. F. O. Emerson has been appointed master mechanic of the Louisiana & Northwest, with office at Gibsland, La.

Mr. Jas. J. Hill has been elected vice president of the Spokane Falls & Northern, with headquarters at Spokane, Wash.

Mr. Frank Johnson has been appointed master mechanic of the Mahoning division of the Erie Railroad, vice Mr. Willard Kells, promoted.

Mr. Henry C. Benagh has been appointed superintendent of the Savannah, Thunderbolt & Isle of Hope Railway; headquarters at Savannah, Ga.

Mr. J. T. Whedon has been appointed superintendent of the United Verde & Pacific, with headquarters at Jerome, Ariz., vice Mr. John Burns, resigned.

Mr. A. G. Machesney has been appointed master mechanic of the Cornwall Railroad, with office at Cornwall, Pa., succeeding Mr. C. J. Herman, resigned.

Mr. E. W. Knapp has been appointed master mechanic of the Michoacan & Pacific, with headquarters at Zitaenaro, Mex., vice Mr. W. H. Rice, resigned.

Mr. J. E. Barrett has been selected to fill the position of superintendent of the Yreka Railway, made vacant by the death of J. T. Schultz; headquarters, Yreka, Cal.

Mr. Wm. Wright, chief draftsman of the Pennsylvania shops at Altoona, Pa., has been appointed general foreman of all the shops of the Terre Haute & Indianapolis.

Mr. Thomas Donahoe has been appointed master mechanic of the Western division of the Erie at Huntington, Ind., succeeding Mr. John Hawthorne, resigned.

Mr. A. S. Bosworth, purchasing agent of the Maine Central, has resigned, and is succeeded by his former assistant, Mr. C. D. Barrows; headquarters at Portland, Me.

Mr. Joseph Longstreth has resigned his position as master mechanic of the Schoen Pressed Steel Company, and has accepted a position with the Baldwin Locomotive Works.

Mr. E. N. Hurley, after eight years of service with the United States Metallic Packing Company, of Philadelphia, has resigned his position as general agent to engage in other business.

Mr. P. A. Gorman, formerly general manager of the Waco & Northwestern, has been appointed assistant superintendent of the Houston & Texas Central; headquarters at Waco, Texas.

Mr. J. E. Gould has been appointed master mechanic of the Toledo & Ohio Central shops at Columbus, O. He was formerly assistant master mechanic of the Pennsylvania lines at Dennison, O.

Mr. William Forsyth, mechanical engineer of the Chicago, Burlington & Quincy, has been appointed superintendent of motive power of the Northern Pacific, vice Mr. E. M. Herr, resigned.

Mr. John T. Peach, foreman of the Atchison, Topeka & Santa Fé roundhouse at Topeka, Kan., has been promoted to the position of general foreman at Fort Madison, Ia., vice Mr. Wintercheck, transferred.

Mr. P. A. Kirk, of the Louisville & Nashville, at Covington, Ky., has returned after spending several weeks in Pittsburg, visiting the Westinghouse Air-Brake plant and many other places of importance in his line.

Mr. C. J. Thompson, yard master and general foreman, car department of the Pittsburg division of the Western New York & Pennsylvania, has been given the additional duties of general foreman on the New Castle division.

Mr. G. Wirt has been appointed master mechanic of the Louisville terminals of the "Big Four" and Chesapeake & Ohio, succeeding Mr. W. A. Bell, who has assumed the duties of master mechanic of the Wabash terminals at Chicago.

Mr. W. W. Pitts, whose headlight button we illustrated and advertised some time ago, joined Roosevelt's Rough Riders and was with them in the Santiago fights. He was reported well after the battle and we hope he will soon be able to return to his business.

Mr. John Hawthorne has been appointed master mechanic of the Lehigh Valley at Sayre, Pa., vice Mr. J. N. Weaver, resigned. Mr. Hawthorne will have supervision of motive-power affairs on the Auburn division, assisted by Mr. George F. Richards, with office at Cortland, N. Y.

Mr. W. E. Green, superintendent of the Southern division of the Kansas City, Pittsburg & Gulf, has removed his headquarters from Shreveport, La., to Texarkana, Texas. In addition to his other duties he has been appointed general manager of the Texarkana & Fort Smith, a branch of the K. C., P. & G.

The following changes have been made on the "Big Four": Mr. Geo. W. Bender, superintendent Chicago division, has been appointed superintendent of terminals at Indianapolis. Mr. Bender will be succeeded at Chicago by Mr. H. F. Houghton, assistant superintendent, and the office of assistant superintendent will be abolished.

The following changes have been made on the Chicago, Rock Island & Pacific: Mr. A. L. Studer, late master mechanic of the Southwestern division, has been appointed to the Illinois division (headquarters at Chicago), and Mr. John Gill, late master mechanic of the Illinois division, has been appointed to the Southwestern division (headquarters at Trenton, Mo.).

Mr. E. M. Herr, superintendent of motive power of the Northern Pacific, has resigned to accept a responsible position with the Westinghouse Air-Brake Company. Mr. Herr is thirty-eight years of age, and has been in railway service for twenty years, beginning as a telegraph operator on the Kansas Pacific. In 1880 he went to the Pennsylvania shops at Altoona as an apprentice and finished his apprenticeship in the West Milwaukee shops of the Chicago, Milwaukee & St. Paul. He served five years with the Chicago, Burlington & Quincy as draftsman, engineer of tests, superintendent of telegraph and division superintendent, and left there to go with the Chicago, Milwaukee & St. Paul as master mechanic at West Milwaukee. In 1892 he was appointed superintendent of the Grant Locomotive Works at Chicago, and the beginning of 1895 he accepted the position of assistant superintendent of motive power and machinery of the Chicago & Northwestern, which position he resigned January 1, 1897, to go to the Northern Pacific as superintendent of motive power.

EQUIPMENT NOTES.

Barney & Smith are building twenty flat cars for their own use.

Two sleeping cars for the Baltimore & Ohio are being built at Pullman's.

The Pullman Palace Car Company are building ten sleeping cars for their service.

The Pullman Company are building 1,000 freight cars for the Baltimore & Ohio.

The Chihuahua & Pacific have ordered one passenger car built at Barney & Smith's.

The Gila Valley, Globe & Northern have ordered one passenger car built at Pullman's.

One passenger car is under construction at Pullmans for the Chicago & Eastern Illinois.

The Centralia & Chester are having sixty freight cars built by the St. Charles Car Company.

The G. & O. Braniff Company are having twenty cars built by the St. Charles Car Company.

The Michigan Peninsular Car Company are building 1,000 freight cars for the Union Pacific.

The Ohio Falls Car Company are building 100 freight cars for the Cincinnati, New Orleans & Texas Pacific.

The Schenectady Locomotive Works are building ten eight-wheel connected engines for the Southern Pacific.

One six-wheel connected engine for the Alabama & Vicksburg is under way at the Baldwin Locomotive Works.

The Carnegie Steel Company are having two six-wheel connected engines built at the Baldwin Locomotive Works.

One hundred and fifty freight cars are being built for the New Orleans & Northeastern by the Ohio Falls Car Company.

One consolidation engine is under construction at the Baldwin Locomotive Works for the San Marcos & Tecolutta.

The Baldwin Locomotive Works are building twelve six-wheel connected engines for the Government of New Zealand.

The American Railway & Land Company are having two consolidation engines built at the Brooks Locomotive Works.

The Baltimore & Ohio Southwestern are having six eight-wheel connected engines built at the Baldwin Locomotive Works.

The Galveston, Houston & Henderson are having two six-wheel connected engines built at the Rogers Locomotive Works.

The Dickson Locomotive Works are building two six-wheel connected engines for the Detroit, Grand Rapids & Western.

One six-wheel connected engine is being built at the Baldwin Locomotive Works for the Rio Grande, Sierra Madre & Pacific.

The Chicago, Milwaukee & St. Paul have ordered five six-wheel connected engines to be built at the Baldwin Locomotive Works.

The Richmond Locomotive & Machine Works have just closed a contract with the Plant system for twelve locomotives, and with the Georgia & Alabama for four locomotives.

The Tars' Welcome.

The return of our naval heroes fresh from their glorious work at Santiago was celebrated on August 20th by one of the heartiest and most enthusiastic welcomes a grateful people ever extended to victorious warriors. If the honest old burghers of Manhattan Island could have seen the way their old town was torn up they would have thought they had died none to soon. New York was out on that occasion to receive the victorious fleet, and when it steamed up the North River on its way to Grant's tomb, the people were simply wild. The vessels were led by the flag ship "New York," after which came the others in the following order: "Iowa," "Indiana," "Brooklyn," "Massachusetts," "Oregon" and "Texas." There were few signs of conflict about the ships, and but for their war dress of dark paint, it would hardly be suspected from the shore that they had so recently been in range of Spanish guns. A closer inspection, however, showed a few marks from shot, but the damage was of such a character as to be easily repaired at sea, although a few dents were still visible on the steel sides. It was an inspiring sight to see the jackies in their white uniforms, and waving their hats in response to the whistles, continuous yells from the loaded river craft, docks, and tops of buildings. A sight for the gods, indeed, and a man that could not enthuse over it had blood too thick to be an American. Everything that would make a noise was brought into action and the tars will not soon forget their welcome home.

A general strike of railway employés in France is imminent, according to late advices, they having failed to adjust their grievances with the railways by reason of the refusal of the latter to treat with any but their own employés. The men are making an effort to have the trades unions espouse their cause, and are deliberating on the best means to make a telling blow.

WHAT YOU WANT TO KNOW.

Questions and Answers.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(69) W. H., Gainsville, Texas, writes:

I have a Nathan sight-feed lubricator that, with repeated cleaning out, will, in forty or fifty miles, fill up on one side. I cannot find anything in it. Can you say what the cause is? A.—The tallow pipe is in all probability obstructed or choked. This would prevent the free circulation necessary to the proper working of the lubricator. We would recommend that the pipe be cleaned thoroughly, and if there is then no improvement, apply the circulating valve of the Nathan Company, a device designed to overcome excessive back pressure, and also the effects of a small or choked tallow pipe.

(70) C. R. S., Raton, N. M., asks:

What are the distinguishing features of the Franklin Institute screw thread, and why is it thus designated? A.—We will answer these questions in a reverse order by saying that, on account of the need of a better system of screw threads than prevailed at that time, a committee of the Franklin Institute, of Philadelphia, recommended, in 1864, the adoption of the system devised by Mr. William Sellers, also of Philadelphia. It is therefore properly the Sellers system. This thread is different from the English or Whitworth system in the angle of the sides of the threads to each other, which is 60 degrees, and in the fact that the top and bottom of the thread is flattened an amount equal to one-eighth of the pitch. This system is now widely known as the United States standard, on account of its general use in this country.

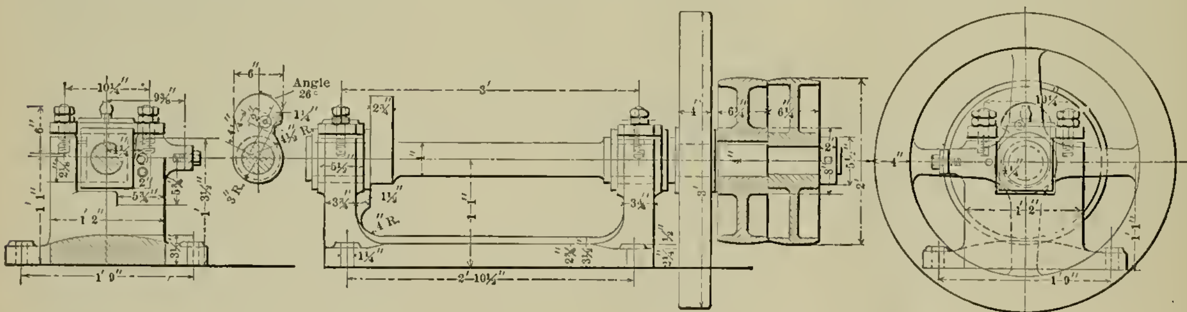
(71) R. L. F., Waterville, Me., writes to ask if a locomotive compresses steam as high as boiler pressure. A.—Recent investigators claim that the popular belief that an early exhaust closure alone can compress steam up to boiler pressure is an erroneous one, but show that excessive lead in connection with early closure of the valve to exhaust will for a very short period of time cause a pressure higher than that in the boiler. Indicator cards having a loop at admission seem to bear out this theory, the plausibility of which is shown by the absence of both the loop and shock at high speeds, when the lead is reduced. It is a significant fact in this connection that when the point of lead opening is well defined on indicator cards, it always shows a pressure due to compression alone, below boiler pressure, even when the loop at admission is excessive.

(72) W. C. T., Two Harbors, Minn., writes:

Is the weight equally distributed on an 8-wheel connected engine, the equalizer running clear through on both sides? The four back driving boxes get hot without extra care, and in sliding, the back wheels have the longest spots. The two rear axles go through the ash pan, and when sliding occurs it is to be presumed that the front wheels are protected in a measure by the scale and grease on the rail. A.—Yes, since the function of an equalizer is to distribute the weight equally on all driving axles it connects with. The general practice, however, for an engine of the eight-wheel connected type is to equalize the first pair of drivers with the engine truck, and equalize the second, third and fourth pair of drivers together if the engine is a consolidation, as we assume it to be. We are unable, with the data given, to establish any connection between equalization and flat spots on the wheels. The fact that the four boxes of the two back axles get warm without extra care is explained by their proximity to the grate, where they are sure to absorb some of the heat and much of the dirt from the ash pan, even with a proper protection sleeve or cover on the axles.

(73) J. H. M., Philadelphia, Pa., writes:

I notice that the Baldwin Locomotive Works are drilling through the length of a set of locomotive axles, the 9-inch driving axles having a 2½-inch hole, and the 5-inch truck and tender axles a 1-inch hole. I am informed that these axles are stronger than solid axles of a like diameter. Will you kindly tell me why this is, and if it has been successfully practiced, or is it an experiment? A.—A hollow driving axle of the above dimensions is not stronger than a solid one of the same diameter; on the contrary, it is about 0.6 per cent. weaker, which can be seen by a comparison of the resisting moments of the two sections, but the hollow driving axle will weigh about 8 per cent. less than the solid one. This is the first instance coming to our knowledge of locomotive axles being made hollow, although crank pins have been thus made for some time, and it has long been the practice to use hollow shafts in marine work. In the latter case the reason for preference of the hollow shaft over the solid one is ascribed to the difficulty of obtaining a homogeneous structure at the center of the shaft, where the welding is most always imperfect, leaving holes, or what is technically known as piping. This trouble, however, cannot be looked for in axles for locomotives, and the reason for using them hollow is, without doubt, to decrease weight.



ROTARY SHEARING MACHINE.

A Rotary Shearing Machine.

The cutting-off machine with revolving cutter, shown herewith, was designed and built at the Canadian Pacific Railway shops, at Montreal. It will cut stock up to 1 inch in diameter with a facility that is rarely duplicated by the average reciprocating machines used for the purpose of cutting off bar iron.

A steel cutter, ⅞ inch thick by 2 inches wide and 3½ inches long, is let flush into the outside face of the revolving cutting head, and held in place by a slotted screw tapped into the cutter. A like steel cutter is let into the inside face of the end of frame, in line with the first. The cutter revolves sixty turns a minute, and with the energy stored in the 36-inch fly-wheel, the machine does work of the most satisfactory character.

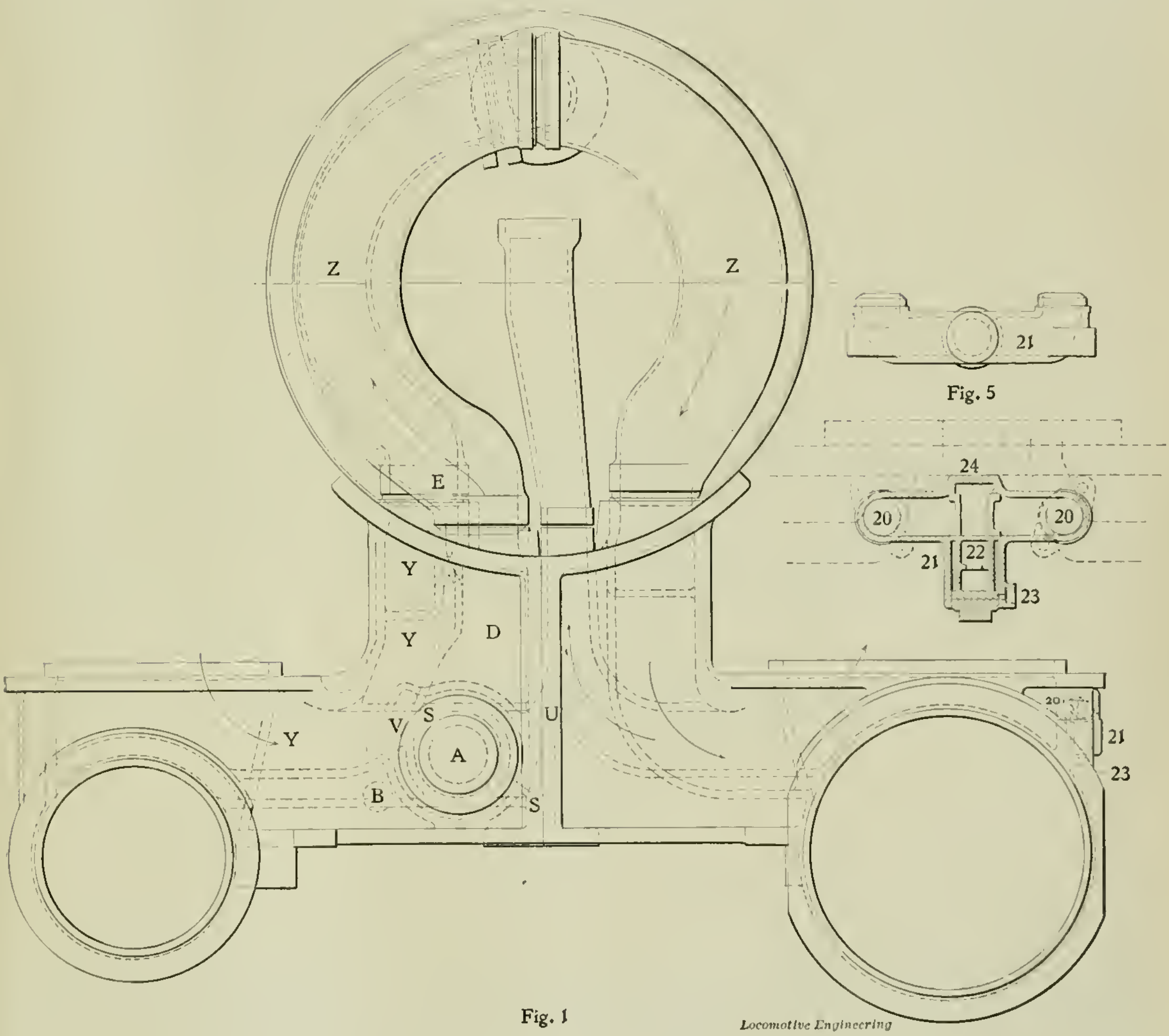
The question of educating train crews as well as the engineer and fireman, has been raised in some quarter, and there seems to be plenty of room for good work in this quarter.

Rogers Locomotive Company Compound System.

In our engravings of the Rogers system of compounding locomotives, Fig. 1, is a view from the front showing the H. P. cylinder on the right-hand side of the engine. The intercepting valve and reducing valve are located in the saddle of that cylinder at *A*. The regulating valve, Fig. 4, for changing from simple to compound, and vice versa, is located at *B*, Fig. 1, and consists of a small cylinder 1¾ inches diameter in which is a slide valve of the common "D" type, operated by a lever, and a rod from it to the cab.

Fig. 2 is a sectional view of the intercepting valve referred to, as located in the saddle of the H. P. cylinder. *C* is the exhaust passage of the H. P. cylinder. *D* is a steam chamber above it through which the exhaust steam passes on its way to the receiver, when the engine is working compound. *E* is where the receiver is connected. *F* is the "regulator" referred to. *G* is a circular chamber around the sleeve *H*, in which the cylindrical part of the intercepting valve is located. This chamber *G* is connected with the H. P. steam passage *Y Y* in the saddle by a port shown at *V*, Fig. 1, and is practically a part of it. *I I*, Fig. 2, is a series of holes in the sleeve *H*, 1 inch diameter, connecting *G* with the space around the reducing valve *L* by a series of corresponding holes *P P* in the cylindrical body of the intercepting valve *J J J J*. The intercepting valve *J* has another series of holes, near the valve face, shown at 10, to the right of and outside of the seat of the reducing valve. Fig. 2 shows the intercepting valve *J* on its seat (closed), and the reducing valve *L* off its seat, open as it is when working simple, except that *L* is then brought near enough to its seat to "wire draw" the steam and thus reduce the pressure behind *L* to practically one-half of that in front of it, so that the pressure in *D*, by the operation of the reducing valve, will never be more than half that in *G*. *K* is a cylinder in which the piston part of *L*, the reducing valve, moves. It is practically one-half the area of the valve *L*. *M* is a chamber, or rather an extension of *K*, and is always open to the atmosphere through the two holes *N* and *O*. *R* is the exhaust valve in the chamber *S S* through which the exhaust from the H. P. cylinder passes to the outlet at *U*, Fig. 1, where it enters the exhaust passage of the L. P. cylinder, and passes from there on to the stack through that exhaust pipe, whenever the engine is working simple, both cylinders then exhausting through the one pipe.

When the valve of the regulator *F* is in the position shown in Fig. 2, and the throttle is open, steam from *Y* and *G* passes into *F* and through the ½-inch pipe and port 8 into *W* and pushes the intercepting valve to the right, onto its seat, as shown in Fig. 2, at the same time causing the holes *I* and *P* to correspond,



VIEW OF CYLINDERS—ROGERS COMPOUND.

and steam from *G* to flow into the chamber around *L* and on out through the holes 10 into *D;* but as the cylinder *K* of the reducing valves piston, and chamber *M* are open to the atmosphere through the holes *N* and *O*, the piston in *K* will be moved with the pressure behind it to the left, and *L* be drawn towards its seat, and as the valve is of larger area than its piston, it will not entirely close until the pressure in *D* (a back pressure on *L*), combined with the pressure on the piston of *L* towards *M*, equals or exceeds the pressure on the piston side of *L*, so that the reducing valve automatically prevents the pressure behind *L* (in *D*) from being more than abo"t one-half that in front of it (in *G*) by "wire drawing" between then closed, a very slight pressure in *C* will open the intercepting valve, moving it to the left, to the position shown in Fig. 3. The exhaust from the H. P. cylinder then passes up through *D* to the receiver, and the engine works compound. When *J* is open (Fig. 3) the holes *P* do not then correspond with the holes *I* in the sleeve *H*, and no steam from *G* can pass to the receiver, the reducing valve being then rendered inoperative, and as *J* at its shoulder seats itself on the offset at *O*, no leakage of steam to the atmosphere can occur in case any should get by the packing rings.

If the regulating valve is moved to its central position, as shown in Fig. 4, when the throttle is closed, and the latter receiver pressure on the larger diameter of the intercepting valve towards the atmospheric chamber is greater than that of the H. P. cylinder steam on the smaller diameter of *IV*.

If the engine is started "simple," the regulator being as in Fig. 2, it will continue to work "simple;" but by changing the regulator to either the position of Fig. 3 or Fig. 4, it will automatically go to "compound," on account of *R* closing and being held on its seat, and the pressure in *C* accumulating to about 20 per cent. of that going to the H. P. cylinder at the time as explained, in the case of the regulator being in the position shown in Fig. 4.

To prevent, as far as possible, the effects

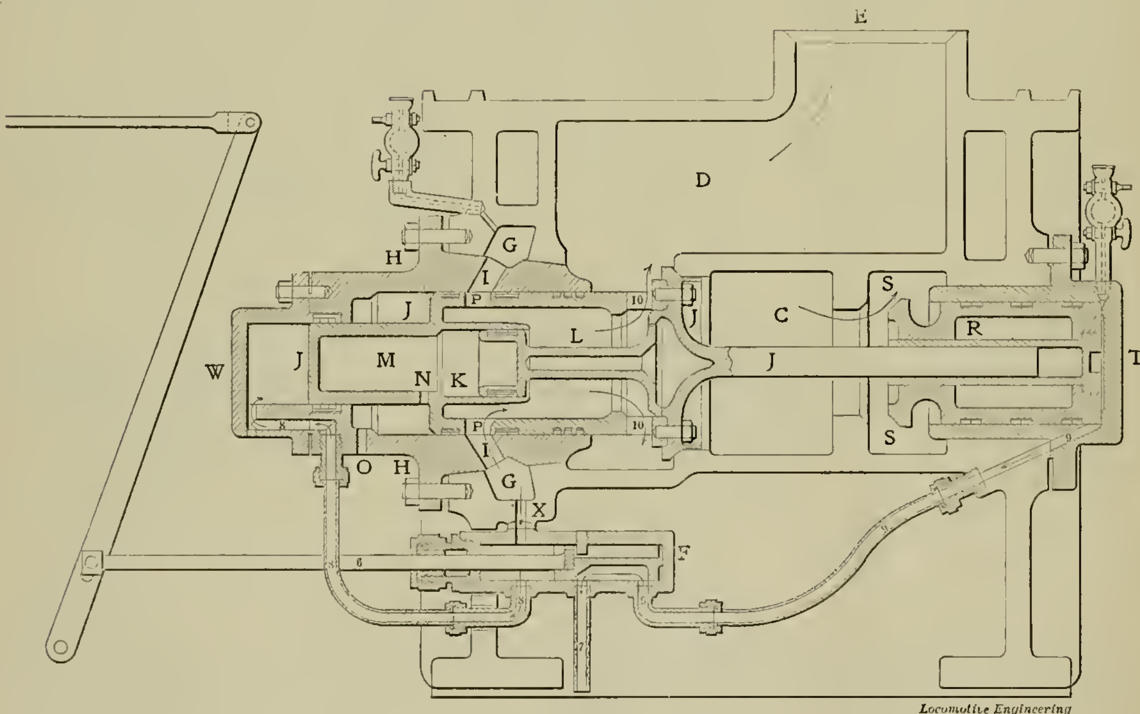
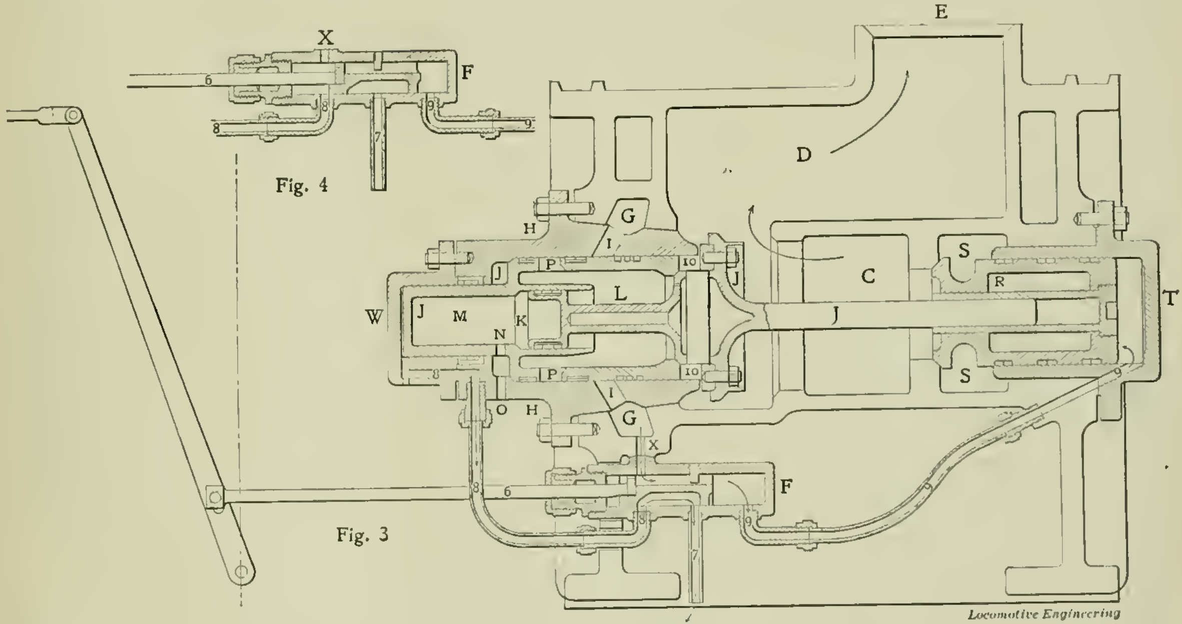


Fig. 2

INTERCEPTING VALVE IN SIMPLE POSITION.

L and its seat, giving to the L. P. cylinder steam at a pressure no more than about one-half that going to the H. P. cylinder at the time, whenever the engine is working simple. When the regulator *F* is in the position shown in Fig. 2, the chamber in the end of *T*, back of *R*, is in exhaust through the ½-inch pipe and ports 9 and 7 to the atmosphere, and *R* will remain as shown (open), consequently the engine in that case will work simple; the exhaust going out through *S S* to the L. P. cylinder exhaust passage, Fig. 1.

If the regulator valve is moved to the position shown in Fig. 3, steam will then flow through the pipe 9 9 into *T*, push and hold *R* to its seat, and at the same time *W* will be in exhaust, and as *R* is then opened, steam will flow in at *X*, and as both ports 8 and 9 are uncovered, the chambers *T* and *W* will be filled and the valves *R* and *J* instantly closed on their seats. *D* (the receiver) would then be filled with steam from *G* and *L* and holes 10 at the reduced pressure, but as soon as the pressure in *C*, from the exhaust of the H. P. cylinder, equals about 20 per cent. of the pressure going to the H. P. steam chest at the time, the influence of the receiver pressure on the larger diameter towards the atmospheric chamber at the outlet *O* will move the intercepting valve to the left (open) to the position shown in Fig. 3 against the pressure on the smaller diameter in *IV*, and it will remain open, as the total of the of compression in the L. P. cylinders when running "shut off" at high speeds (as, for instance, down grades, when no steam is needed in the cylinders), a "by-pass" arrangement is used similar in some respects to that called the "Le Chatalier" arrangement. Fig. 5 shows this on the outside of the L. P. cylinder below the steam chest seat. The dotted lines show the two port openings of the cylinder below the valve seat. A hole 2 inches diameter is made into each, as shown at 20. Connecting these is a short pipe 21; in this pipe is a cylindrical valve 22. When the valve is down in its chamber, as shown, the port through pipe 21 is open, leaving a free passage from the port at one end of the cylinder to that of the other. To the lower end of this valve chamber at 23 is connected a ½-inch pipe from the steam chamber in the saddle of the H. P. cylinder, so that when that cylinder receives steam, this chamber receives it also at 23, and the valve 22 is raised up to the top of its chamber 24, closing the passage through 21, and remaining there as long as the H. P. cylinder is receiving steam, but when the throttle is closed and the chamber *Y* of H. P. cylinder is empty, the valve 22 falls by gravity to the position shown, leaving the passage open—that is, it is closed when steam is being used and open when the throttle is closed.



INTERCEPTING VALVE IN COMPOUND POSITION.

The New York & New Haven Railroad in 1854.

"'Way back in the early fifties, when the New York & New Haven road was young, we had a new superintendent, Mr. G. W. Whistler, who was a West Pointer. He introduced blackboards for orders, and had the orders numbered; they never had been before. Then he had the conductors wear a special cap, and later a uniform, and wanted the engineers to select one, too. We selected our regular overalls and jumper, and never had any other.

"One day a young dudish-looking chap came on board with a pass to ride on any engine at any time, etc. He measured water in tanks and noted what was used. Calculated everything you could think of, and could make you blind with figures, which didn't mean anything—to us.

"We had some Roger engines, same size as the other makes, but they could lay 'em all over the decks any time, and we couldn't tell why—only they did.

"In those days we didn't have steam gages, just safety valves that were set by the maker to blow off at the right pressure—80 pounds in this case—and we couldn't screw 'em down any more.

"Well, this young fellow figured out the safety valve levers and found that the reason the Rogers were so much smarter than the rest was that we were carrying 110 instead of 80, as marked. Perhaps this was an accident; perhaps not.

"This young man was Zerah Colburn, and we never thought much of him or his figures, till he started *The Engineer*, in about 1854, and began telling us practical things about handling our engines and getting home if anything happened. Then we came to the conclusion he knew more than we gave him credit for."

Such was part of our interesting chat with Mr. Joseph Clark, now superintendent of engineers at the Continental Iron Works, who is an old-time railroader.

A Broken Link Hanger.

"About the slickest trick I ever saw done in the way of quick repairs, was over in Jersey, on the old Jersey Midland road, now the New York, Susquehanna & Western.

"They had some new Rhode Island engines, and I was firing for a fellow named Barnes, who had one of them. Coming down with an express one day, one of the link hangers let go, as they will sometimes, and Barnes began hustling around to take off the rods and block the valve on that side, so as to get home one-sided.

"He hadn't much more than started, when along came a fat, good-natured looking chap, who was in the cars, and Barnes told me he was the man who put the engines on the road.

"'What's the matter, Barnes?' he asked. 'Broken link hanger? Well, don't strip her. You get those rods back all right and I'll fix her underneath,' and he grabbed a block of wood and went under the engine.

"He was out in a couple of minutes and told Barnes to go ahead, but not to drop her down below 16 inches. Barnes got on and started, and then wanted to know what he'd done, and why.

"'Just slipped a block into the link on the broken side, so she'd cut off at about 16 inches on that side. The weight of links and eccentric rods hold it in, and that side works at 16 inches all the time. That lets you start your train in good shape, which you couldn't do with one side up here on the hill, and you can cut-off in your other cylinder where you please, so long as you don't go below 16 inches. If you do, your lifting shaft arm will be in the way of the eccentric rods and the link, and you'll have grief on hand.'

"Well, to make a short story long, Barnes got in only a few minutes late, and learned one trick about link hangers."

Various reports and observations show that railroad shops are unusually busy in many places. Most railroads are getting engines and rolling stock in shape for the heavy fall shipments. Heavy crops and the early ending of the war ought to make more business than we have had for several years.

Electric Motors.

The article in the May issue gave an idea as to circuits and though they may not have appeared to have any connection with motors, they were really a step in the understanding of them.

Electricity can be compared to steam in many ways, but when it comes to pressure (volts) there is a difference. In steam we deal with the actual pressure; in electricity we deal with the difference in pressure between the terminals (or inlet and outlet for current) of the machine or lamp. A lamp in series, Fig. 7, may only be a 50-volt lamp or have a difference of electric pressure (commonly called "potential") of 50 volts between the terminals, and yet have the pressure 450 volts at *a* and 400 volts at *b*. In steam boilers we could of course arrange them in a somewhat similar way, but the full pressure would be on the appliance representing the lamp, while in this case the lamp is only subjected to 50 volts pressure, and the terminals will only show 50 volts on a volt meter. The amount of current will of course depend on the resistance of the lamps. Fig. 7 gives an idea of the different pressures, and shows how it drops from lamp to lamp or motor to motor. The current remains the same in this arrangement. The current starts at 500 volts and drops to zero at the last lamp.

Electric railways, with few exceptions, are run on the multiple-arc system, as shown by Fig. 8, in which the car motors are between the trolley wire and the rail. The overhead wire carries the current out; it passes down the trolley pole to the motors, and after being used, goes to the rails. The pressure in the wire is 500 volts (usually) that of the rail's zero. Either wire or rails can be touched with impunity, but not both at once—nor must the wire be touched while there is any connection with the ground. Linemen often repair the trolley wire, with current on, but they are on wooden platforms, which are insulated from the ground. A stream of water, from the ground to the man, would complete the circuit and shock him. In the third-rail system, the rail takes the place of the overhead wire, the return circuit being by the rails and earth, as before.

Just as it is safer and better to give a locomotive a little steam at a time, to start with, so it is best to start a motor in this way; but it is entirely different. You open the throttle a little, and some steam crawls through; but you must open or close an electric switch as quick as you know how, to prevent burning or melting the points of contact. The current must be choked or throttled in some other way. The first way was to use resistance coils, which were coils of iron or German-silver wire (chosen because they have a greater resistance than copper), and use coils enough to get sufficient resistance to cut down the current to a safe point. As the motors gained speed, part of the coils were switched out and more current admitted to them. This was not economical, as the current was consumed in the coils.

Now, when the motorman twists his coffee grinder on the car platform, several things occur in rapid succession, and the economical use of current, the life of the motor and the easy starting of the cars depend largely on these "controllers," as they are called.

Resistance coils are still used, but they are not depended on solely. The usual method now used in modern equipments is about as follows: The first notch of the controller puts both motors of the car in series, and also puts in all the resistance coils. Placing the two motors in series only gives each 250 volts, and the resistance coils cut this down lower yet. As the car gains speed, the next move is made, cutting out half the resistance; motors still in series. Third notch cuts out all resistance, but leaves motors in series. In this position there is no current wasted in resistance, but only 250 volts are utilized in each motor. This gives moderate speed.

The fourth notch throws the motors in

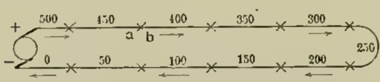


Fig. 7

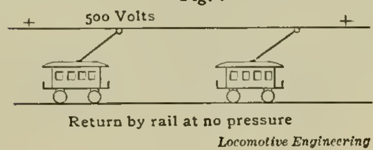


Fig. 8

parallel (or multiple), giving each 500 volts, but again introduces the whole resistance. Fifth notch cuts out half of this resistance, and the next cuts it all out, leaving the motors free and in parallel. This gives greatest speed and highest economy. It isn't unlike "hooking-up" a locomotive, the difference being that there are other difficulties to contend with than slipping the wheels. If this care was not taken, the current would rush through the motors and, meeting with little resistance when they were standing still, would pass a sufficient current to burn them out. In other words, the heat generated would destroy the insulation from the wires, if not melt the wires themselves.

When the motor starts, the revolving armature begins to act as a dynamo, and generates a current which resists the current it is receiving from the wires. This is similar to compression or back pressure in an engine, and is called "counter E. M. F." E. M. F. means electro-motive force, or voltage. As the speed increases, the counter E. M. F. does the same, and prevents too much current rushing through when the resistance coils are thrown out. This is also the reason that the motorman drops the coffee-mill back a notch or two when the car slows up too much on a hill, as the decreasing counter pressure might allow current enough to burn out his motors.

So far nothing has been said about motor winding, such as shunt, series or compound, but that, together with the alternating current, which is as yet not in practical use on railways, will be left for another time.

Forging and Pressing.

The ends of a forged shaft, or other article, give a pretty fair idea of its interior, as far as telling whether it was forged with a very light or a heavy hammer. If the ends are hollowed out, the hammer was too light, and only the outer skin of the metal was moved or forged properly. If the ends are rounded out or "bulge," the hammer was heavy and worked the whole mass of metal. Such a bar will be found more solid than the one with hollowed ends.

An interesting incident which shows the difference between hammer forging and pressing by steady pressure, was given by Prof. Sweet recently. He had a male die, and wished to make its mate by forcing it into it. The die and the steel intended for its mate were put in a hydraulic press and pressure applied. The expected didn't happen, and instead of making the desired impression there was only a slight dent, the whole mass of metal evidently flowing a little instead of being indented at one point. The two pieces of steel were then placed under a drop hammer, and one blow did the work. This indicates that if you wish to forge one particular spot, it is best to use a drop hammer; but if an even flow of metal is desired, a press gives excellent results.

We recently noticed one of the large passenger engines with a heavy through train slip furiously in attempting to start, and saw the engineer attempt to give her sand. The attempt was almost ludicrous, as the sand pipe deposited the sand many inches ahead of the drivers, and it is safe to say that not 5 per cent. of it landed on the rail, and this only along the outer edge, where it was comparatively useless. The remaining 95 per cent. decorated the ties and road-bed. With the numerous efficient sanding apparatus now on the market, it is difficult to understand why they are not more generally used, as in this particular case a tenth part of the sand used (or wasted) blown under the driving wheels would have given much more satisfactory results. It is true the engine finally started without this, but the wear and tear on both engine and track due to repeated slipping, to say nothing of sand wasted in the course of a year, would go a long way toward equipping the engines with sanders.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

The Shaw Brake-Slack Adjuster.

The Shaw brake-slack adjuster is one of the adjusters patented during the past year, and exhibited at the conventions of the Air-Brake Men and Master Car Builders.

A pamphlet recently issued by the manufacturers of the adjuster, tells us that "the Shaw adjuster is bolted to the guard-timber of the passenger truck, and to the bolster of the freight truck. It is connected to the long end of the dead lever by means of a chain, and derives its actuating movement by means of a connecting rod from the long end of the live lever. The action on the dead lever is precisely the same as in the case of adjustment by hand.

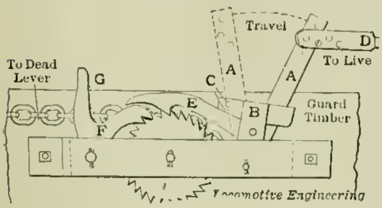


Fig. 2.

"The operation of the Shaw brake-slack adjuster is as follows: When the brakes are applied, lever *A* will move to the position of dotted lines in Figs. 2 and 3. As the shoes wear, the stroke of lever *A* will carry forward the actuating frame *B* until actuating pawl *E* advances a notch in the ratchet wheel. When this takes place, and the brakes are released, the actuating frame is carried backward, the actuating pawl revolves the ratchet wheel and drum, and the retaining pawl *F* takes up a notch; by which means the dead lever is drawn over by the chain which winds around the drum, thus taking up the slack.

"To apply new shoes, raise the pawls from the ratchet wheel by pulling on arm *G*. This will allow the chain to unwind from the drum, and the lever to return to its original position. Any undue slack will be taken care of by the adjuster.

With the Shaw method of adjusting, the angles of the cylinder, floating and live levers are the same when the shoes are worn out as when they were first applied. We are aware that the loss of braking power, due to the angularity of levers, is minimized in some quarters; but no arguments or tests can disprove the fact that at the moment a lever is carried beyond a right angle, loss of power begins and increases in proportion to the angularity. Time and experience will show that there is but one right place for a brake-slack adjuster to do its work, and that is the end of the dead lever.

Southern Pacific Air-Brake Circular.

The following air-brake circular, under date of May 15, 1898, has been issued from the general manager's office:

FOREIGN CARS—AIR BRAKES: PIPING.

San Francisco, Cal., May 15, 1898.

To Superintendents, Agents and Connections:

The rolling stock of the Southern Pacific Company is equipped with the Westinghouse automatic air brake.

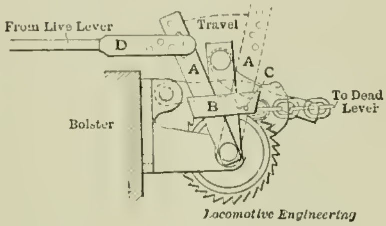


Fig. 3.

Atlantic System.

The Atlantic system of this company will continue to receive foreign cars at junction points as heretofore, whether equipped with the Westinghouse automatic air brake or not, provided such cars are not loaded with freight destined to points west of El Paso.

If foreign cars are tendered for points west of El Paso without the automatic air brake, the contents will be transferred, unless they consist of commodities named hereinafter, in which case the cars will be accepted for through service, if properly piped for hauling in trains handled with the automatic air brake, and if otherwise in good running order, complying fully with the M. C. B. rules.

Pacific System and Oregon Lines.

The Pacific system and Oregon lines of this company will not receive cars at junction points unless equipped with automatic air brakes, except when laden with the commodities named hereinafter, and then only when properly piped and complying fully with the Master Car Builders' rules, and of railroad ownership, except as shown below. [Then follows a list of commodities consisting of perishable and other freights impossible to advantageously transfer—Ed.]

Tank cars loaded with oil or other liquids will not be received unless equipped with automatic air brake.

Must Remove New York Brakes.

The United States Circuit Court for the District of New Jersey has decided a case in favor of the Westinghouse Air-Brake Company against the Central Car Trust Company and the Commerce Dispatch Company, whereby these two latter companies are required to remove infringing New York air brakes from 1,400 cars which they control.

In reply to the defendants' remonstrance that they would be seriously inconvenienced by removing so many brakes, the court pointed out that the defendants had purchased these cars equipped with infringing apparatus after being duly warned by the Westinghouse Air-Brake Company that the brakes on the cars infringed their patents. The Westinghouse Air-Brake Company requested the removal of the infringing brakes and offered to supply their own apparatus at a reasonable figure, but the car companies declined. Having been duly warned, and

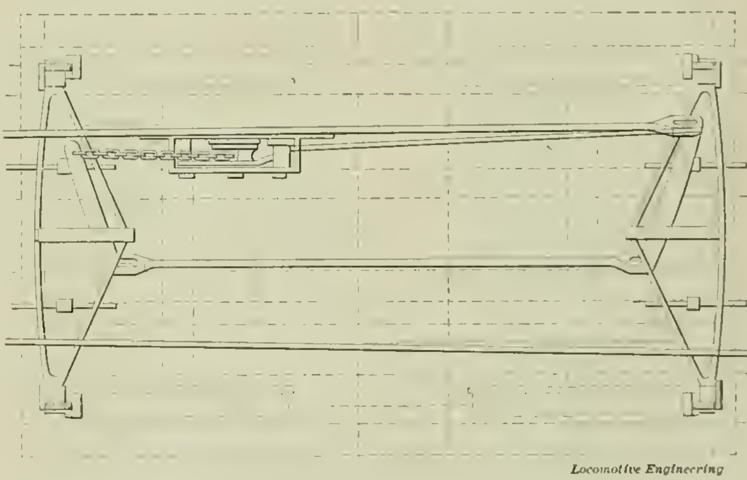


Fig. 1. SHOWING TOP VIEW OF SHAW SLACK ADJUSTER.

having gone into the matter with open eyes, the defendants were therefore not entitled to any special consideration of the court.

Don't Overlook the Retaining Valve.

The failure to properly look after and test the retaining valve along with the rest of the air-brake apparatus, is shown by Mr. Humphrey, superintendent of motive power of the Colorado Midland, who recently said at the Saratoga convention of Master Car Builders: "Just before coming to the convention I had the inspectors at one point keep a record of a little over 1,500 cars and test the retaining valves to see how many of them were really effective out of 1,500. There were 137 retaining valves that would retain the pressure to exceed three minutes. These cars were taken promiscuously from different roads, and there was not 10 per cent. on which the retaining valves were of any value whatever, and they might as well have been off the cars as on them."

More Attention Needed.

In the rush to equip freight cars with air brakes, railway companies are apparently inclined to more or less neglect the maintenance of those brakes already in use.

During the discussion of maintenance of brakes at the Saratoga convention of the Master Car Builders, Mr. Bush, superintendent of motive power, P. C. C. & St. L. Ry., said: "I recently made some investigations covering the present conditions of air brakes. It bears indirectly on this question and shows the necessity of something comprehensive for taking care of brakes. Taking a lot of air-brake cars, in over fifty the air brakes were in such a deplorable condition owing to lack of care, that the service application could not be obtained at all, except with the maximum reduction. In a great many cases service application could not be obtained at all; only the emergency application. The condition was found to be much worse than I expected."

These are not idle words. Instead, they truly express the condition in which a very considerable number of air brakes now are, and towards which others are rapidly drifting. There are many air plants throughout the country, but it is doubtful if in all cases they are utilized to the interest of the air brake. The novel uses of compressed air for cleaning coaches, changing car wheels, hoisting car bodies, running drills, etc., in many instances deprive the brakes of the care they rightfully deserve. Indeed, we know of several air plants equipped with efficient compressors solely utilized for the above purposes, and not a single brake at those points receives attention otherwise than that given it by the inspector after the engine is coupled on a few minutes before leaving time, or that generously donated by the train crews on the road.

A number of the prominent members have spoken before the several clubs and conventions recently on the subject, and in each instance it has been to warn railroads that they are rapidly approaching an alarming situation which a reasonable amount of immediate attention may avert, but which blindness to the present needs of the air brake will ultimately bring an almost endless and impossible amount of work.

CORRESPONDENCE.

Air-Braked Wheelbarrows.

Editors:

It is believed that Air-Brake Superintendent Hawks, of the Chicago & Alton Railroad, is the first to equip wheelbarrows with air brakes. It is not to be assumed that on these barrows any pretence has been made to avoid the skidding of wheels, or the wheel rather, but to provide a vehicle for conveniently moving the apparatus necessary for properly testing the air brakes on cars and trains in yards having the usual air plant for conducting the air about the premises.

Chicago, Ill. S. J. KIDDER.

Another Reason Why Brakes Refuse to Apply.

Editors:

Reading your answer to question 81, August number, reminds me of another prolific cause of failure of air brakes to work, especially on long trains, on which, in applying the brakes, considerable time elapses between the closing of the preliminary exhaust port and equalizing discharge valve, and that is, a leaky piston of the latter valve.

In making the desired initial reduction of train pipe pressure, it may perhaps be necessary to make a number of reductions of the equalizing reservoir pressure owing to the former swelling the latter. On account of the slow reduction of the train pipe pressure, it may occur that there will not be sufficient pressure in the cylinders at any one time to force the pistons by the leakage grooves, hence its escape to the atmosphere.

Yours very truly,

E. H. BELDEN,
D., L. & W. Ry.

Scranton, Pa.

An Experiment.

Editors:

I do not feel quite satisfied with the explanation as given by you in answer to G. M. N., Question 11, page 53, January, 1897, number, as to purpose of small port, leading to top of cap nut, over reversing valve of air pump.

Your answer says: "If there was live steam on one end of rod, and exhaust steam on the other, there would be a tendency to force rod against weaker pressure, and reverse main piston, without use of reversing plate."

Let us take main piston on its downward stroke. Reversing valve is now in its upper position, with cavity in valve, uncovering exhaust port from above reversing piston. From the position the valve now occupies, it is possible to force it still a little further up, causing cavity in valve to partly uncover admission port, thus creating an additional exhaust port from above reversing piston. With no port to top end of reversing rod, this might happen, caused by excess pressure on lower end of rod, but it would not reverse movement of main piston; not till it completes its stroke. The above could not take place on the upward stroke of main piston, as there is then exhaust steam at both ends of reversing rod.

As an experiment, I removed cap nut from above reversing valve of an 8-inch pump, and plugged small port, replaced nut and started pump, watching closely for any change in working of pump, such as an uneven stroke, or its sudden reversal, but after ten minutes running failed to notice any. The pump apparently worked as well with port plugged as it did before. Perhaps lack of lubrication at upper end of rod might finally have interfered with the pump's proper working.

H. THORNBURG,
Engineer, N. C. & St. L. Ry.

Paducah, Ky.

[If the rod fit snugly in the cap nut, there would be compression in the nut when the main piston finished its up stroke. Immediately upon the reversal of the pump, the compression in the nut being greater than the steam pressure on the lower end of the rod, would cause the rod to start downward, providing it was not so tight as to bind or lacked lubrication, and the pump would reverse. With a worn rod and cap nut this compression would not result unless the pump were running rapidly. Possibly in your experiment the rod and nut were not snug fits and there was little tendency to form compression.—Ed.]

Operation and Care of the Feed Valve Attachment.

Editors:

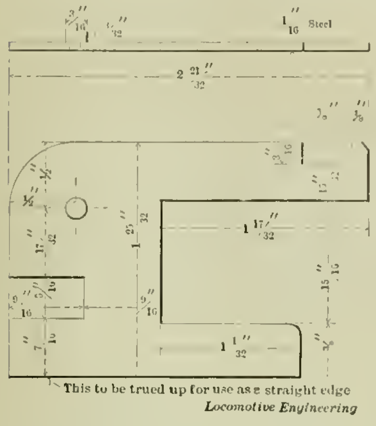
I am enclosing you an article on the feed-valve attachment which, with the accompanying print, it was thought you might desire to publish for the benefit of your readers.

The gage is in use on about ten other roads in this territory and, along with the instructions, is assisting materially, in obtaining more satisfactory results from the feed-valve attachment.

OPERATIONS OF ATTACHMENT.

The feed-valve attachment, as is well known, is to regulate the pressure in the train pipe when the valve handle is in running position. The regulating spring holds the piston up and supply valve open until train pipe pressure, which is above piston, increases to an amount that compresses regulating spring, and allows supply valve to either seat or close to that point where leakage is just supplied.

Train pipe leakage tends to reduce slightly the pressure at which feed valve will regulate, the amount being dependent



GAGE FOR FEED VALVE ATTACHMENT.

on the opening of supply valve necessary to feed leakage.

In operating the 1892 engineer's valve, the handle must be left in full release a sufficient length of time to insure release of rear brakes, but must not be allowed to remain there long enough to charge the auxiliary reservoirs above standard pressure. Should this ever unintentionally occur, the pressure should, by applying and releasing without recharging, be at once worked down to an amount that will permit of release without again overcharging.

Where a very small reduction from a fully charged long train would entail either stuck brakes at rear or an overcharge, prevent by making a further reduction before releasing. Speaking broadly, to release the brakes on a train of from twenty-five to fifty cars, the handle should be left in full release from five to fifteen seconds. The shorter the train or greater the difference between train pipe and main reservoir pressures just previous to making release, supposing the former has not been reduced below the point of full application of brakes, the less time is required.

Where a release must soon be followed by a reapplication and release, the valve handle should be returned to lap as soon as brakes are off after first application, so as to insure ample excess pressure for second release. This is but another form of the oft-given instruction that so long as air couplings are to be made, the train pipe and auxiliary reservoir pressures should be kept moderately low, and main reservoir pressure as near as possible to maximum amount allowable.

Guard against a Plate D-8 valve being placed on an engine carrying such high boiler pressures as 180 or 200 pounds, unless some provision is made for preventing main reservoir pressure exceeding a safe amount with valve handle on lap.

ADJUSTING, TESTING AND REPAIRING.

When necessary to adjust a feed-valve attachment, pump up maximum pressure, and then make a leak from train pipe sufficient to represent that from an average train. This may be done by opening almost full the bleeder (release valve) on either tender or driver brake reservoir. Terminals should have a special device made by closing the end of a hose coupling, drilling and tapping for ¼-inch plug and making a 3-64-inch or 1-16-inch hole in latter to cause desired leakage. By substituting a tested air gage for the ¼-inch plug, the same coupling may be employed in the examination and adjustment of engine air gage.

After every alteration of feed-valve regulating nut, make a 15-pound service reduction and return valve handle direct to running position, but do not move to full release. Having set feed valve thus, then in running position pump up to maximum train pipe and main reservoir pressures, place valve handle in full release for about two seconds, return to running position, and after leakage has reduced train pipe pressure to point where feed is supplying, note difference from previous amount. A slight difference is to be expected; but when 5 pounds or more, it indicates undue resistance to movement of piston 45, Fig. 1, and should be corrected. Either the friction ring 38 fits too tight in the cylinder, the collar of piston rod 37 binds in the ring, piston binds against side of cylinder, or the rod bears where it passes through adjusting spring or enters nut 41.

When, after regulating as directed, and then stopping leak, an increase of several pounds follows latter operation, but train pipe shows no further tendency to increase to main reservoir pressure, this indicates undue resistance to final downward movement of piston, or that just as supply valve 34 is nearly seated. This is generally caused by a distorted diaphragm 43, made so by long service, oil getting on it, or spring box being screwed up too tight.

A test that will enable the repairman to easily detect any such undue resistance to piston movement, is to remove regulating spring, invert and return its nut, and, with feed-valve cap nut off and supply valve held in place by a finger, move piston rod to full up stroke and then down until supply valve is seated. If the end of piston rod be drilled and tapped for a ¼-inch bolt, the regulating nut may be returned to its normal position and the same device used to move the piston as is employed in removing the reversing piston from the 8-inch pump. Pliers tend to abrade the end of piston rod, and cause the trouble sought to be eliminated. It should also be seen that regulating spring binds at no point on piston rod, and is free in its nut.

If, with valve apart and diaphragm ring in place over piston-rod collar, it requires any appreciable force to bring the lower faces of these two parts flush, this indicates a distorted diaphragm. Where not too bad, a betterment sometimes results from inverting the diaphragm pieces.

The spring box should be screwed up against the diaphragm but little harder than may be without a wrench. Guard against setting it up more when tightening check nut. Should spring box be screwed up to a joint against body, not only would diaphragm be damaged, but the supply valve might be prevented from seating. Especially is this true if piston rod collar has been sprung down. This may be done by using too much force on feed-valve piston nut in an endeavor to bring it to position when diaphragm is too thick or has not been put on central. In replacing diaphragms, place them on the piston, enter rod through latter, and hold firmly until nut is well down. This to keep them central, and they should be tested for this by putting the ring in place and seeing that lower piece fits in recess and upper one is true with outside of ring. To guard against spring box being screwed up too tight, it is well to insert sufficient tin or other thin washers over its threads to take up most of the space left after diaphragm has been clamped hard enough.

The gage shown in Fig. 2 is to assist in maintaining the necessary standards of construction. One side is finished to be used as a straight-edge, and this must be employed first to see that piston-rod collar, the striking point, is not dished on bottom. Collar being true, gage from its lower face to top end of rod; distance, 15-16 inch. This being right, or made so, and with piston and nut in place, use flat

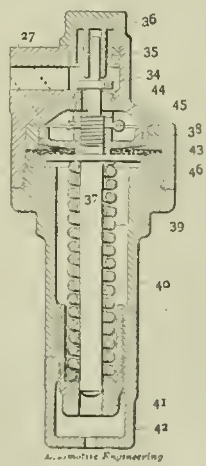


Fig. 1. FEED VALVE ATTACHMENT.

part of gage with protruding pin to measure distance from top of rod to three striking points on nut, which should be 3-32 inch, or nearly so. With all other parts standard, a port opening greater than that through rotary will be got if previous measurement does not exceed ⅛ inch.

Next gage from finished cast-iron face, where nut strikes on upward stroke, to valve seat at top of brass bush, which should be ⅜ inch. Where necessary to face this bush, shim up under its collar with paper until original dimension is restored, and see that bearing width of its seat is maintained standard.

Next gage lower stem of supply valve, which should be 9-16 inch. Finally, by use of the ⅛-inch prong on part used to test the ⅜-inch dimension, see if guide in cap nut has been sprung, as has sometimes inexcusably been done by striking on top of nut, thus causing guide to cock and hold the supply valve unseated. Do not unduly tighten this nut. Supply-valve stem should fit neatly in guide to prevent cocking.

Use no metal in cleaning supply valve or seat. A piece of wood with water or oil is best, and passageways should be blown out with air before replacing valve. Where time permits, remove diaphragm from feed valve and place other parts in lye water. Steam or hot water quickly softens the accumulation on supply valve.

Where piston is difficult to remove, and air pressure can be got, take firm hold of rod, and by carefully moving valve handle to commencement of full release position the piston will be forced out. Otherwise use a hard wood plug from above, as a metal punch will damage end of rod.

Sometimes a new supply valve will leak on account of very slight imperfections, resulting from service, in the brass bush it seats on. A useful tool for quickly correcting this is a round piece of hardened steel, with end ground true, and having a removable center pin. If the brass seat requires other than mere rubbing down with oil, use only such grinding material as finely powdered glass or pumice stone, as any considerable grinding will require raising seat, previously mentioned.

Where, by adjusting, pressure cannot be prevented from feeding up too high in train pipe, reduce 10 pounds below standard amount, return valve handle to lap, and quickly closing train pipe cut-out cock under valve, note whether pressure again rises. If so, either the lower gasket is leaking from main reservoir passage through on top of piston, or rotary valve seat is defective. But in case black hand does not then rise, it is either a faulty feed valve case gasket or a leaky supply valve, most likely the latter. To determine which, remove piston and, with handle in running position, the port underneath at which air is escaping will locate the defect. However, this is supposing all parts are standard, spring box was not screwed up too far, nor diaphragm so distorted as to resist final downward movement of piston.

The most severe test for lower gasket, rotary or feed valve is that of closing the train pipe cut-out cock under brake valve. So small a train pipe space is left that, with valve in running position, a slight increase on black hand is to be expected. But if over 5 pounds, the cause should be located and remedied.

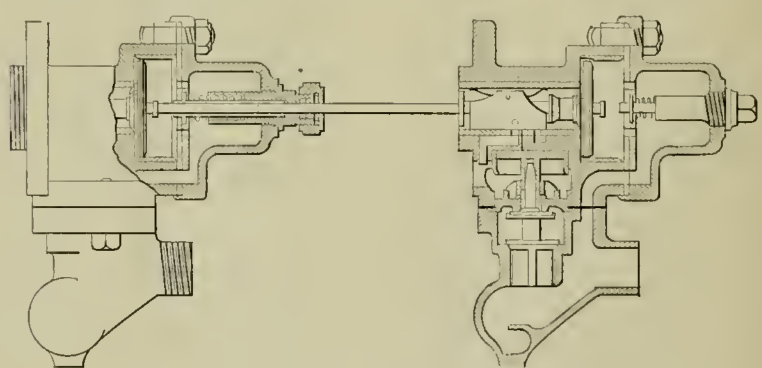
F. B. Farmer.

St. Paul, Minn.

Tandem Quick-Action Triple for Instruction Purposes.

Editors:

You will find enclosed a sketch representing a device which is used on the Chicago & Alton road for instruction purposes in air brakes. There is a rod connected to the working triple valve and extended through the graduating nut, and attached to a skeleton triple valve. The motion of the live triple when working gives the skeleton valve the same movement, which is a great help in understanding the graduating features of the quick-action triple valve.


TANDEM TRIPLE VALVE FOR INSTRUCTION PURPOSES.

W. W. Updegraff,
Chicago & Alton R. R.

Bloomington, Ill.

Cars Fitted with Air Pipe and Hose Only.

Editors:

This article was brought to my mind by reading an article in the *Railroad Gazette*, published April 22, 1898. It is entitled "Cars Fitted with Air Pipe and Hose Only." It was one of the questions discussed at the March meeting of the Western Railway Club, at Chicago.

One prominent member said that he was not in favor of piping any cars, but to have the whole equipment of every road equipped with power brakes.

Another said that he had recommended that a number of the old light cars on his road be equipped with pipes only. He also said: "Those who are connected with lines from Chicago west well know of cars equipped with pipe only, used in traffic west of the Missouri River. This is practiced by the Union Pacific and by the Southern Pacific quite largely and with success, and it seems to me that it is a matter deserving of considerable attention." It is with reference to this that I wish to write.

There appears to be considerable controversy throughout the country in regard to the number of air-braked cars that should be in each train, so as to make good stops; also, if a certain number of the cars cannot be advantageously piped and mixed in air-braked trains. This controversy all comes from the Interstate Commerce Commission having urged the different railroads to put on automatic couplers and have a train brake under the control of the engineer.

There are doubtless a good many roads in the country that have not yet recovered from the last great business depression, and are therefore not in a condition at the present time to spend the money for these improvements. For this reason the Interstate Commerce Commission extended the time two years. A number of railroads, however, have conceived the idea of partially equipping their freight cars with continuous brakes, and fitting the rest out with piping only.

I am very often asked how many cars in a freight train should be equipped with the automatic brake, so that the engineer shall be able to make all stops without the use of hand brakes. My reply is invariably that I do not know; that I think all of the cars should be equipped, then we would be able to give some idea of what kind of a stop could be made.

We will take, for illustration, a railroad that has not over a 35-foot grade. Say that the trains are rated at 50 loads and that sixteen cars, or one-third of the train has power brakes. Now, with the powerful locomotives that are used at the present day, an engineer can get a swing on a train of this kind of at least 30 miles an hour, and more than likely over that. Suppose he comes on a flag that is not out far enough, or where the section men have a rail up and have neglected to send out a flag; or he has run by his orders and meets another train, or perhaps the dispatcher has given a lap order. In any of these emergencies the engineer has a very poor show to make a stop, with only this number of braked cars in the train, before an accident happens, and the accident will probably cost more than it would cost to have had all the cars equipped. On the other hand, there is no doubt but that the engineer could make all station stops with a train of this kind, as he would know the road, and after making one stop, would know how far from each station to commence applying the brakes so as to make a good stop.

There is no doubt that there are railroads in this and other countries, where freight trains could be operated successfully by having only partially equipped trains of power brakes; but with the list of accidents that I have mentioned staring them in the face, they would also have the danger of the train breaking in two back amongst the non-air cars, and running together before anyone would discover it; also the danger of breaking in two, say, with one or two of the air-brake cars on the rear. Of course if the cars were all alike and the same weight and capacity, this would not occur; but today we are hauling, in freight trains, cars from 15 tons up to 100 tons.

Now in regard to piping cars, I have had considerable practical experience in this matter, and I can say positively that it is not a success. When the Southern Pacific Company first applied the automatic brake to their freight cars, they transferred all freight at their terminal points, Ogden, The Needles and El Paso; consequently they handled none but their own cars. About 1886 or 1887 they quit transferring, and commenced to receive Eastern cars. As very few of the Eastern roads had the brake on freight cars at that time, of course the Eastern cars had to be piped.

To illustrate to what an extent this matter was once carried on, I remember seeing a full train of twenty-four cars going West out of Ogden one day, that had only seven air-brake cars, and the rest were all piped so as to have the air clear to the gage in the caboose. Now, when there are several piped cars in a train and the brake is applied, the train stretches apart. The piped cars not having any brakes applied, will surge back and forth until a link or pin breaks, or the draw head is pulled out. As you air-brake men well know, the quick action will only jump a certain number of cars that are cut out or piped.

I have known piped cars to be received here that had an old straight air hose on each end, with the valve in each one. The other coupling had no bridge, consequently the air could only go to the back end of that car. I remember one car equipped in this way that caused one collision and a runaway down a short grade. Found another piped car once that had a piece of broom stick in it. This is due to the fact that refuse pipe and hose are generally used to pipe cars that have no brake. The Southern Pacific Company has had so much trouble here with piped cars that they are very cautious about receiving them. An order was issued some time ago about what kind of loaded cars would be received with pipes. I send you a copy of a re-issue of this notice up to date. [This order appears elsewhere in this department.—Ed.]

The Denver & Rio Grande Railroad receives piped cars, but will only allow a specified number in a train over the Tennessee Pass, where there is a 3 per cent. grade.

The Colorado Midland will receive piped cars, but if they have only a single hand brake, that is if the brake is applied to one truck only, they apply the hand brake to the other truck, and remove it when the car is to be returned.

The Rio Grande Western will take very few piped cars, and then only when loaded with something that is very hard to transfer. They will not take any piped cars unless they have double hand brakes. They have to do this because in taking trains down their 220-foot grade on the Wasatch Mountains, from Soldier Summit to Clear Creek, a distance of seven miles, every car has to hold itself. So when they have a piped car the hind brake has to be clubbed. Two cars cannot be held with one brake down this grade.

I cannot say just what the Union Pacific are doing in this matter, on their own line, but I know that they turn over very few piped cars to the Southern Pacific.

Several years ago the Southern Pacific refused to take piped cars or cars without air brakes from the Santa Fe at Mojave or The Needles. The cars had to be transferred at these points. This was done, however, because the Southern Pacific had a 3 per cent. grade for 25 miles down the north side of the Tehachapi Mountains.

In going through the yards at San Francisco or Oakland, Cal., it is very seldom that I see a piped car any more. If I do, it is some car whose contents is inconvenient to transfer.

When the Interstate Commission published the list of roads last fall, giving the percentage of brakes and couplers applied to the different roads, the Southern Pacific showed up 96 per cent. on brakes. The Pacific system is actually 100 per cent. The Atlantic system have some old cars that they never equipped. They are kept in local service down there and are not allowed to come west of El Paso. That is the reason the Southern Pacific does not show up to 100 per cent. on the brake question.

H. C. Frazer.

San Francisco, Cal.

A Good Air-Brake Report.

Editors:

The following monthly report for July of our air-brake inspector may be of interest to your readers, as it is almost entirely based on a temperature test, our docks being at the foot of a 13-mile hill.

As soon as a train stops with brakes set, the inspector runs over the train and marks the temperature of wheels, then goes over again and locates the cause of too hot or too cold wheels. We have no night inspector, consequently this report covers about one-half of the cars received during the month. This is a very good test on this road, because the yard is at the foot of a long hill, and again because all cars are loaded, and almost equally loaded.

The report is as follows:

Number of trains, 346.
Number of cars, 9,861.
Hose coupling leaks, 219.
Defective train pipes and angle cocks, 7.
Leaks in pipe joints where marked, 470.
Defective triples, 65.
Defective release valves, 38.
Defective retaining valves, 203.
Leaky brake cylinders, 60.
Defective hose, 24.
Piston travel under 5 inches, 221.
Piston travel over 9 inches, 283.
Bleeder wires missing, 102.
Brake rod broken, 1.
Brake beam broken, 1.
Pistons broken, 10.
Cars set out for repairs, 160.
Cars cut out and found O. K., 25.
Total defects reported, 1,756.
Broken in a wreck, 1 N. Y. No. 2 pump, 1 N. Y. B. V., 2 brake cylinders, 4 auxiliary reservoirs broken, 2 quick-action triples.

D. P. Kellogg,
A. B. Instr.,
Duluth & Iron Range R. R.

Two Harbors, Minn.

The Traveling Engineers have two good air-brake subjects to discuss at their coming convention, which meets in Buffalo September 13th. The subjects are: "What is the best method to be pursued by Traveling Engineers in giving air-brake instruction while on the road?" and "The proper care of the engineer's valve while in service, and what is essential to the successful handling of air-braked trains."

The Westinghouse Air-Brake Company has closed a contract to furnish a large number of brakes to the government railways of Russia. These brakes will necessarily be manufactured in Russia, and a representative of the Westinghouse Air-Brake Company is now there negotiating with the government.

The packing ring of the triple valve piston should never be removed for cleaning, or any other purpose, until it has been finally removed for renewal. A ring once taken out and replaced is distorted more or less, and can never again fit with the degree of nicety that the manufacturer fitted it when he ground it in with oil

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(82) D. W. B., Delaware, O., asks:

What remedy can be used with a D-8 valve to keep engineers from using full release position as a running position, allowing some train-line leakage? A.—Keep the excess pressure valve clean, and spring adjusted to no more than 20 pounds. Some repair men have drilled a warning port in the D-8 valve similar to that in E-6, and claim good results.

(83) W. W. W., Bloomington, Ill., asks:

Why are the holes placed in the emergency piston only in the 14-inch special triple valve? A.—To give a larger escape opening to the brake cylinder pressure when brakes are released. This allows the air in the 14-inch cylinder to escape in about the same time as the other brakes. Otherwise it would take longer to get the air out of the large cylinder.

(84) M. C., Bradford, Pa., asks:

Why, when hand brakes are being used to assist air brakes, should they not be set at rear end rather than behind air brakes? A.—When hand brakes are set on rear end, the slack of the entire train runs out when air brakes are released, and the strain on the couplings and draft is liable to break the train in two. With hand brakes set immediately back of the air cars, the slack runs out of the air cars only.

(85) M. C., Bradford, Pa., asks:

Is it a bad idea if using ten cars of air to steady forty cars on a descending grade to set up four or five hand brakes directly back of engine on air-brake cars, not cutting out air brakes? A.—It is best not to do it, as it is not necessary, and these cars do double duty of air brake and hand brake. Many wheels have been heated and cracked this way. If hand brakes are required to assist in holding the train, use those immediately back of the air-brake cars.

(86) W. H. S., Salt Lake City, Utah, writes:

In your September, 1897, issue (question 103, page 703), you give the size of preliminary exhaust in the D-8 valve as 3-32, in the F-6 as 5-64. In May, 1898, issue (question 44, page 243) you give size as 5-64 for both valves; which is correct? A.—At the time the first answer was given, the sizes of the preliminary exhausts were, respectively, 3-32 inch and 5-64 inch in the 1890 and 1892 valves, as the D-8 and E-6 valves are now called. Since then one standard has been made by the manufacturers for both valves.

(87) M. C., Bradford, Pa., asks:

Why is it some triples make a continual kind of a fluttering sound when coupled in with train and charged? Some do this continually. A.—Dirt on the rubber-seated valve, or a poor rubber seat, allows train pipe air to leak into the brake cylinder from the little chamber between the rubber-seated valve and check valve. The check valve keeps rising and seating to supply this chamber from the train pipe proper. This movement is rapid, and the fluttering is really a series of rapid seatings of the valve. Making the rubber-seated joint tight will stop the fluttering.

(88) M. C., Bradford, Pa., writes:

Progressive Questions and Answers says if brake has been partly applied in service, go to emergency, and if you get no emergency you will at least get service quicker. How is this? The hole from auxiliary to brake cylinder is smaller in emergency than in service, is it not? A.—When the triple makes its full traverse, air passes from the auxiliary reservoir to the brake cylinder through the cylinder port, and also through the emergency port to top of emergency piston, thence around the edges of the loose fitting emergency piston to the brake cylinder. These two passages together are larger than that through the graduating valve passage.

(89) G. E. H., Tacoma, Wash., writes:

Will you please inform me how it is that 60 pounds is obtained in brake cylinder and auxiliary reservoir when an emergency application is made? Does the amount of air in train pipe added to auxiliary pressure raise pressure in brake cylinder and auxiliary reservoir to 60 pounds? A.—Yes, but in this way: Before the application is made the auxiliary has 70 pounds, train line 70 pounds, and brake cylinder no pressure. A sudden reduction in the train pipe actuates the quick action parts of triple, causing train pipe pressure to be vented to cylinder. This pressure when reinforced by the auxiliary pressure equalizes at about 60 pounds. The triple, during this application, has made its full traverse, and a direct communication is had between the brake cylinder and auxiliary. Consequently there is 60 pounds in both. At the instant train pipe pressure is vented to brake cylinder the train pipe drops as low as 40 pounds.

(90) W. A. R., Port Huron, Mich., writes:

Would you kindly explain how and when is the lower chamber in the signal valve charged? My instruction books teach me that a portion of the pressure below the diaphragm (in the lower chamber) is used to sound the whistle. Seems strange how it can be recharged through the same opening as it is discharged through. Kindly explain and oblige. A.—The pressure enters the valve above the diaphragm, passes down the port in the side of the valve, thence up along the diaphragm stem, and feeds slowly past the rather snug fit of the upper part of stem in the bush, into the chamber below the diaphragm. To sound the whistle, the pressure above the diaphragm is reduced. The pressure underneath, being equal with that above the diaphragm before the reduction, is greater now, and raises the diaphragm and stem. The snug-fitting part of stem is now above the bush, and presents a free passage for air from the chamber to pass to the whistle.

The Oil Man of 1856.

It is not generally known that the oil question for locomotives and cars dates back nearly half a century—in fact, we were not aware that special attention was invited at that time to economies in lubrication that were destined in our own day to play such an important part in motive-power management. We are placed in touch with the oil question of 1856 by an advertisement of that date, the caption of which reads: "Pease's Improved Engine and Signal Oil for Railroads." The claims made for it were that "it is superior to sperm, or any other oil whatever, and the only reliable lubricator that is a superior burning oil; that it will keep bearings cool, and will not gum."

This has a familiar jingle, except that part refering to the double-head capacity for lubricating and lighting, which looks a little like drawing it too strong. There is nothing said about the chemistry of this wonderful oil, but it was probably one of those magical blends so common at that time.

The "ad" is a good one for those days, and the artist is visible in the further statement that, "this improved oil possesses qualities vitally essential for lubricating and burning, and found in no other oil. It stands a greater heat by 20 degrees than any known oil, consequently will not consume as fast, and is unaffected when other oils are burnt or dried up. It is 33 per cent. cheaper in price, and will last 25 per cent. longer than the best sperm oil." This does not appear to leave much ground for the opposition to stand on.

The receivers of the Baltimore & Ohio Railroad have purchased forty miles of 85-pound 60-foot steel rails, and will experiment with them on the Pittsburg division and in the Baltimore tunnel. These rails were originally bought for the Columbia & Maryland Electric Railroad, which was designed to parallel the Baltimore & Ohio Railroad between Baltimore and Washington, and to become an important factor in business between those points. The project failed, and the material which was purchased has been sold. These are the first 60-foot rails to be used on the B. & O.

The Westinghouse Air-Brake Company has bought out the Boyden Brake Company, of Baltimore, for $900,000, so says the *New York Commercial* of June 27th.

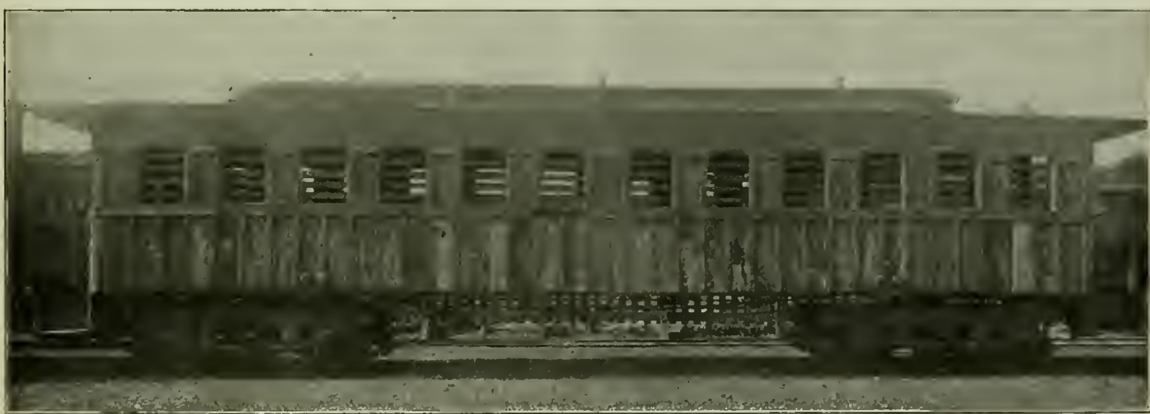
Car Department.

CONDUCTED BY O. H. REYNOLDS.

Abraham Lincoln's Car.

We are indebted to Mrs. Lola Carleton for the photograph from which the accompanying engraving was made. It was taken by her at the Union Pacific shops, in Omaha, in 1894, and shows the car as it was then.

It is now at the Trans-Mississippi Exposition, in Omaha, Neb. This is one of the historical cars of the country, and recalls another war period, far more bitter and heart-rending than the present. This feeling between sections, however, which was caused by the former war has been obliterated by the present one.



CAR USED BY ABRAHAM LINCOLN.

Recent Car Details.

The interest evinced in the perfecting of car details by the inventor is one that is rather deeper than would be suspected, if a knowledge of it were based alone on the devices that force their way to adoption by merit, in which contingency we would probably see very little effort made to revolutionize well-known details, but we are enabled to keep tab pretty accurately on improvements (alleged) by means of the reports issued from the Patent Office, and from that of the week ending August 2, it is gathered that there is a decided tendency to make the American car a better vehicle than it ever was. These records also show the faith that is in them, for the "substantially as described" represents dollars, and is of course an earnest of what the inventor has sacrificed for the common good, and he thus poses as a philanthropist.

Among these candidates seeking the favorable opinion of those interested in car details is a car axle lubricator, having a roller revolving in oil in the journal box, and in contact with the underside of the journal, the roller being held in position relative to the journal by a casing which is supported by a spring having a tension to properly hold the roller against the axle and thus insure lubrication. There is no doubt about the practical value of this device, because it is old—has been tried and cast aside years ago, and will be patented again in years to come.

Another journal box, having the object of lubrication in view, but in a way that looks as though it would do something in that line, is a box with a reservoir for oil cast on the top (not a new idea), and has a duct or passage leading from the reservoir to an oil hole in the center of the bearing. In connection with this scheme of oiling the journal is an arm or arms secured to the end of the axle and revolving with same, whose function is to elevate the oil to the chamber above, after having performed its office of lubricating the journal, thus using the oil continuously. Since the claims do not embrace anything about hard grease that requires a box to be hot before lubrication begins, there is an air of plausibility about the device that arrests attention. It looks like a good thing, or rather it appears to possess the possibilities of something worth having, for oil will flow by gravity to a journal easier than by capillary attraction through dirty and dead soggy waste that don't touch the journal. There is good reason to believe that the reservoir plan would improve the hot box situation.

An ingeniously devised folding step for passenger cars is found in this exhibit, consisting of a riser and tread which are secured to the lower tread of car step and so arranged as to fold, or fall into position as a part of the step, at will. A device of this character would, we think, be of great utility on coaches whose steps are too short to be comfortably reached from the ground by a 29-inch leg, and its adoption in such cases would seem to be the rational way to have common sense steps, at a reasonable cost, on coaches already equipped with the high variety.

The parcel rack for coaches also comes in as a subject for improvement, and receives attention in the direction of making it adjustable to different positions and forms of packages, and so devised as to retain its contents through the medium of a weight, which distends or closes the front in accordance with the size of the parcel. The fact that there are few parcel racks in coaches, worthy of the name, ought to open a field for such as this. A rack that will hold parcels is what is needed.

In addition to the above, there is an automatic flexible coupling for train-pipes for air, gas or steam use, that has the merit at least of originality, and looks as though designed for a purpose; also a brake rod which has been illustrated and described in this paper, and is worthy of the protection of the Patent Office. Besides these there are two improved details of a well-known car-heating system, and also a draft rigging for freight cars. The car department is well looked after, but there is one feature of car economy made prominent by its absence—the coupler. This omission is full of portent, and would seem to signify that the fiend is simply girding up his loins for a fresh break.

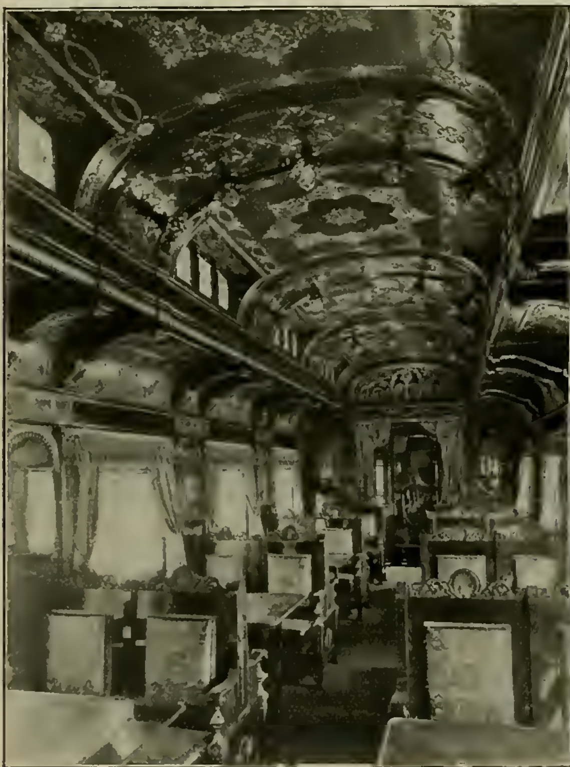
We are receiving frequent requests for standard sizes of pamphlets, etc. We have published particulars several times, but we now give them again to our readers: Postal-card circulars, 3½ x 5½ inches; pamphlets and trade catalogs, 3½ x 6 inches, 6 x 9 inches, 9 x 12 inches; specifications and letter paper, 8¼ x 10¾ inches.

An Association of Car Foremen.

The tendency of railway men to advance in the technique of their business by organizing into bodies composed exclusively of some one branch of the service, has now pervaded almost every department, and the branching off from the main body of an organization into local clubs is simply in conformity with that natural law which applies to birds of a feather. The banding together of the employés of a car department is in line with the never-ending yearning for more light by a class of men who have never made any great hulabaloo in the railroad world, and have been known by their works rather than wind.

The car foremen of roads entering Chicago have now an association having for its object the improvement of its members in all matters pertaining to car repairs and interchange, and the membership therefore is composed of the very sinews of the car departments of those roads. It is a wise move, and will bear fruit for the railroads they represent, just as the sister associations have done, and in a field that has been unworked up to the present time for the want of organization and all that it implies in the way of reciprocity of car thought of the practical kind. The coming together of men of the same calling, and the discussion of subjects of a common interest, can have but one result—a broadening of ideas—and a consequent improvement in the handling of their respective duties.

Such an association is needed, and we have no doubt that it will show cause for its existence in a record of good work. The same need is apparent in all cities in which several roads center, and if car foremen, car inspectors, car builders and repairers, and all others taking an interest in car work exclusively, were to form local associations similar to that of Chicago, and talk up car repairs, inspection and design in all their various phases, they and their vocation would be the better for it, because it would open their eyes to the fact that there were some things yet to learn in their business, and that those things are best brought out by discussion. The car man owes it to himself to take independent action that will bring his department up to the standard aimed at by others, and we are gratified to see the move made at Chicago with that object in view.


PULLMAN DINING CAR.


DRAWING ROOM CAR.

A Limited Express.

Discontented Passenger—I thought this was the limited express?

Conductor (Oklahoma Railroad)—That's what it's called, sir.

Passenger—Ah! What is there limited about it?

Conductor (after reflection)—The time for meals.

Electric Guard Alarm.

In "Transport" we find a description of an electric alarm for the use of passengers in compartment carriages in cases of dire necessity, in which they may communicate with the guard and engine man simultaneously, from any part of the train, by simply pulling a small handle, of which there are three in each compartment, when a bell rings in the guard's van and also on the engine. The electric wires are carried under the coach, and near the ends are made to enter the brake pipe, at which points contact is made with the wire from the adjacent car.

In addition to the audible alarm, there is in connection with it a target, or indicator, that is supposed to fly out from the side of the car and locate the scene of trouble for the information of the guard. There has never been any doubt of the need of an efficient means of communication with the guard in cars of this kind, but any attempt, at the present time, to perpetuate a type of vehicle that makes necessary an elaborate alarm system in order to insure the safety of the passengers, looks like genius misapplied. The American passenger car furnishes an absolutely perfect measure of security, without the necessity of an appeal to the guard or any other person.

The arrangement of seats are far more comfortable and convenient for viewing the scenery, and objectionable persons are more easily avoided.

A New Dust Guard.

The result of some thought in the direction of a better dust guard than any of those in general use, is seen in our engraving of the device gotten up and used by Mr. C. G. Potter, master mechanic of the Nashville, Chattanooga & Tennessee, at Paducah, Ky. This dust guard is made of two pieces, as shown in the different views, fitting the space in the box in the usual way, and fitted together so that they will effectually exclude dust, and at the same time keep oil in the box—the two functions heretofore generally attempted by a single piece of soft wood, with the most unsatisfactory results.

One of the two pieces forming this guard, fills the slot in the box at the bottom half only, having one-half its thickness cut away to a point below the center of its hight, and the space thus left is fitted by the short piece of the guard. As shown in Figs. 2 and 3, the long, thick piece is introduced into the box and the axle passed through the hole, when the short piece is dropped into place in the slot of the box, the two halves just filling to a fit. The edges of the pieces are left apart at the center, so as to allow them to approach as wear takes place.

A small, half-elliptic spring is used to hold the long half of the guard up to the axle, as shown in Fig. 2, gravity holding the short half in contact with the dust-guard bearing. The guards used by Mr. Potter are made of cast iron, and cost, including the spring, about 8 cents for the complete guard. A service of 4,600 miles on a very dusty road developed a wear of only 1-64 inch in the hole of the guard, showing that it would require over five years of wear to bring the shoulders of the guards together. Some of the claims made for this dust guard are: Simplicity of construction, automatic in operation, indestructible if of metal, economy in oil and packing and wear of brasses and journals, and minimum number of hot boxes, besides the fact that they are equally efficient whether made of cast or malleable iron, brass, pressed steel or wood.

In his letter to us concerning this guard, Mr. Potter states that he was impelled to study up on the subject by an article we recently published on the villainous devices in use for dust guards, and being satisfied that a good guard could be built at a reasonable cost, evolved this one, and will soon place it on the market.

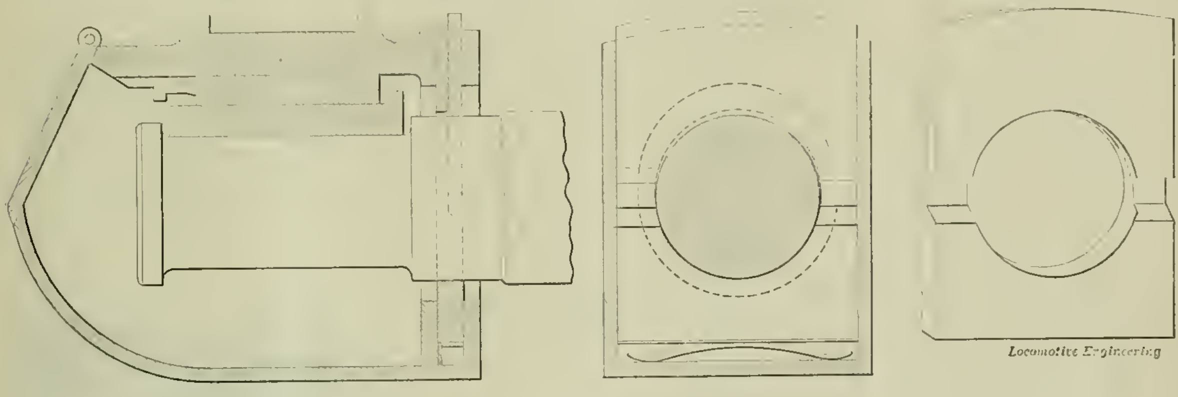


Fig. 1 Fig. 2 Fig. 3

POTTER'S DUST GUARD.

Truck Frames.

The freight car truck has been the subject of as many shafts of ridicule as any other part of our rolling stock. A reason for this is found in the fact that there are more opportunities for giving full sway to freakish visions than in any other place on a car. The proof of this is seen in the numerous builds of trucks—the few parts standard to all being comprised in the axles, wheels, boxes and bearings, and these are interchangeable because they are made a standard by the fiat of an association authorized to decree what shall go on record as standard.

When the important question of a frame is up for consideration, nightmares are born, and the farther from rational thought a designer can steer, the more nearly he imagines himself to approach the ideal thing, and the fact that makes the confusion worse is the possibility of foisting these things on a road in the face of advice to the contrary from those who are responsible for their maintenance.

The fitness of the arch bar frame as against the solid girder seems to be the rock on which all progress splits in the matter of getting to a standard, and since both of these types present inexhaustible openings for radical changes in dimensions without impairing the efficiency of either, the situation must remain as at present until a proper tribunal names some one of them as better than the others.

What holds the truck frame a long way from even the dignity of a recommended practice, is the facility with which the diamond members may be shifted about, and the dimensions altered without apparent injury to the integrity of it, and that is also the reason why so much guess-work has been done by the alleged designers. There are a few arch bar frames, and also girder frames, put up so as to come within the requirements of cost, both first and that for maintenance, and if measured by this gage it would not seem such a difficult matter to name the best of these for the serious consideration of those interested in reducing the output of schemes that cannot lend any aid to the betterment of the present status.

There can be no barrier erected that will hold against the tide of truck frames contemplated or under way, and now flooding the patent office, if action is not taken to show that the field is already more than covered, for the reason that some of them will be sold and find their way on the road, no matter how little they are desired. This action should be taken, not with the idea of having reached that stage of perfection where further improvement is impossible, or for the purpose of stifling intelligent effort, but simply to head off the chaotic and misdirected work of the truck crank.

To best accomplish this end, we believe a standing committee should be appointed on each road by the Master Car Builders' Association, and authorized by that body to note the performance in service of every build of truck on their respective roads; the duty of the committee being to make a detailed report of every weakness due to faulty design, together with the probable or actual expense incurred in correction of same. Information of this character has never been collated except in isolated cases, and probably then to pad promises made by interested parties. The work of a committee on the lines proposed should be a most valuable aid in weeding out the trucks that are too heavy and strong, as well as those that are too light and weak, besides holding the freak at bay.

A Window Washer.

In a large city like Worcester, Mass., it is a common thing to see a man washing the front windows and the "rig" shown in Fig. 1 might easily escape notice, but the writer observed it in use at the Swedish Mercantile Co-operative Co. on Laurel street, and those who made and were using it seemed highly elated with their invention.

It is like an ordinary long-handled win-

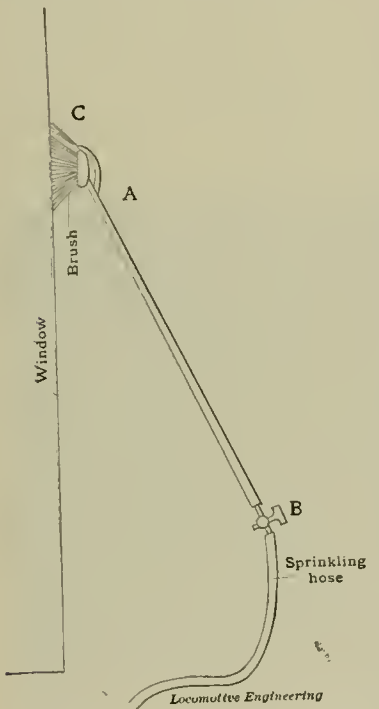


Fig. 1

A WINDOW WASHER.

dow brush, but the handle is hollow and has a pipe running through it, to the lower end of which the regular sprinkling hose is attached. At *A* the pipe comes out and is bent over the top edge of the brush so as to project several small streams or a sheet of water *C* against the glass just above the brush—the supply of water being regulated or shut off at will by means of a cock at *B*. What is the matter with a thing of this kind for washing cars and car windows.

A Plea for Car Standards.

In his paper on "Car Inspection; Past, Present and Future," read before the St. Louis Railway Club, at the meeting of April 8, 1898, Mr. Charles Waughop, chief joint inspector, reached for the present confusion in the design of cars with a mailed hand. His remarks on standards carry weight, as coming from a practical man in a situation to know whereof he speaks. They are so closely in accord with the sentiments expressed repeatedly in this paper that we give them entire:

"I will close this paper by calling attention to one of the most extravagant features of railroading—that is, the non-adoption by the Master Car Builders of standards for the different parts of cars. Personally, I can see no tenable reason why, in this age of steel, we should not have one standard truck for all cars of equal capacity; or, if one is not enough, have two or three. Take, for a basis, a truck of the pressed-steel type for one design, a diamond-frame truck with a steel body bolster for another, etc. The same rule would apply to couplers. Say they adopt five different patterns of the —— type, one would be better, and drop the other fifty-one different kinds on the market. The same idea could be applied with equal advantage on the other parts of the car, such as air brakes, body bolsters, etc.

"Did it ever occur to you that it costs something like (approximately) $3 000,000 per year for inspection of cars for wrong repairs alone? I believe this is a safe estimate; and did it occur to you that this money could be saved if all cars were standard? Look at the millions of dollars lost on delay to cars in one year on account of holding cars on repair track out of service until the proper material can be obtained from the owners of cars, many miles away, to put the car in serviceable condition, which material would have been in stock if all cars were of the same standard. How many millions of dollars have all railroads in North America invested in material for foreign cars, at hundreds of different repair tracks, anticipating a break! If cars were standard, I believe it safe to say that the railroads could do business in this country with 300,000 less cars than they now have.

"The car manufacturers would also be in a position to save a few millions of dollars in the reduction of prices for new cars. This they could readily do, when it is considered that if a standard was adopted, it would be unnecessary for the car manufacturing companies to carry so many different patterns, etc., which are necessary when so many different kinds and sizes of cars are built, each company having its own and different designs."

Private Line Cars Not Wanted.

The San Francisco office of the General Manager of the Southern Pacific Railroad has issued, under date of May 15, 1898, the following notice to superintendents and agents:

"The Pacific System and Oregon Lines, having sufficient equipment to enable them to carry all freight with dispatch and safety, decline to handle cars of individuals or private car line ownership, unless when necessary, in some cases, for the transportation of live poultry, live stock, perishables, bulk fluids, or freight of extraordinary weight or character."

Revision of Standards.

In accordance with the action taken by the Master Car Builders at the Saratoga convention, there is to be a letter ballot on the suggestions made by the Standing Committee on the Revision of Standards and Recommended Practice; the findings of the committee having a direct bearing on the perfecting of standards already adopted. The suggestions to be voted on do not propose any radical departures from present practice; but the one referring to the 5x9-inch axle and journal box, with details, for cars of 80,000 pounds capacity, proposes to remove them from the list of recommended practice and place them among the standards. The remaining changes to be balloted on, mainly referring to alteration of shapes or dimensions, are clearly stated, and while apparently of small moment, are really of importance in bringing details up to the degree of perfection aimed at by the standing committee.

Pneumatic Drills for Car Work.

There is no better way of convincing sceptics of the uses and advantages of pneumatic tools than by showing them at work in actual service. The operator of the drill shown is evidently much more contented and in a happier frame of mind than if he was boring the hole by hand, and the amount of work done is sure to be several times as great. This is the Whitelaw No. 6 piston air drill, which

A HANDY TOOL FOR UNHANDY WORK.

seems particularly adapted for such work, and which is made by the Chicago Pneumatic Tool Company, of Chicago, Ill.

The Excelsior Boiler Gaskets made by the Boston Belting Company have a wire insertion which adds materially to their life. They are used on all pressures, and their durability is shown by their being used over and over, frequently for two or three years. This is quite an item where hundreds of boilers are used.

Frame Splices and Pedestal Binders.

BY R. E. MARKS.

Ever since John Duzenbury went young Philpot "one better" on the eccentric, he (Philpot) has been trying to find a weak spot, so as to get one ahead of said Duzenbury. The other day he came into Duzenbury's office, and as he didn't seem to be particularly busy, Philpot hauled out a couple of sketches for examination.

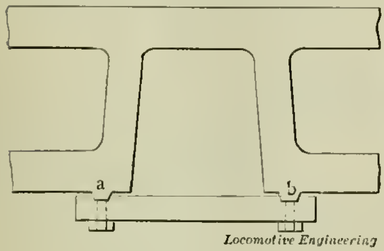


Fig. 1

"When you turned down my eccentric scheme, or proposed a better one, I determined to find something else to show you before many months, and I'd like to have you look at this.

"You know the trouble we have with the pedestal binders on those Blank engines we have? They're so light that they spring and work loose, and all because they aren't made right—'cording to my notion. They're like this, you know," and he sketched Fig. 1 in the dust on an old dictionary.

"They weaken the binder at the points *a* and *b*, to begin with, and then, to make matters worse, they put the bolt plumb through the same place, like this, and it weakens the binder like sixty. My scheme is this (Fig. 2), which doesn't cost any more to make, is stronger at the bolt than in the middle, and will be a binder instead of 'stretcher,' as some of them are.

"The only difference would be in forging a little more metal in the frame at *c* and *c*. Then instead of putting the groove in the binder, put it in the frame, as shown, and fit the binder to it. Even a bolt hole through this part leaves it stronger than the rest of the binder, and I'll guarantee it'll stay put, too.

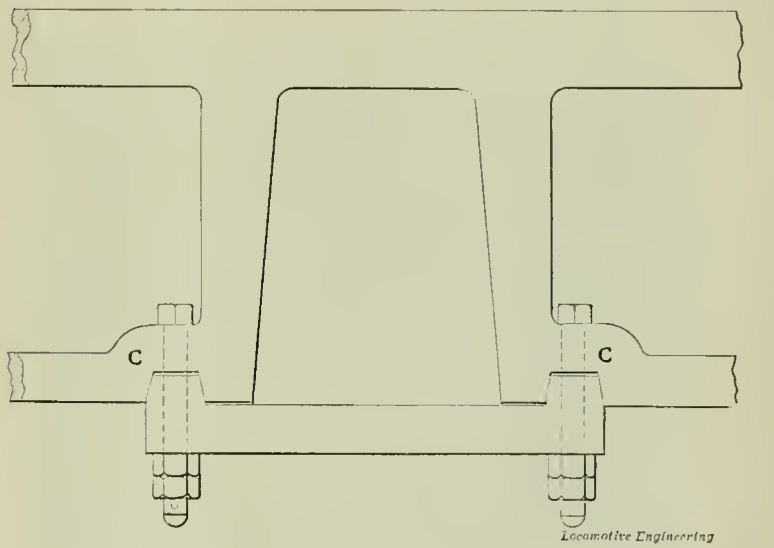


Fig. 2

"Then you know the trouble we've been having with frame splices working loose, and the deuce of a job it is to get at the bolts. Well, I've been thinking it over, and I've come to the conclusion that the frame can't very well help getting loose. Look here, Mr. Duzenbury; here's the regular spliced frame (Fig. 3), and you know these bolts (pointing to *d d*) always come loose or break, while the others stand. Then it's a nice job to fix 'em up in good shape. The long bolts through the splice are terrors to drive out after they've been run a while, and it's my private opinion mighty few of them ever really fit to begin with. It's a nice job to get a 15 to 20-inch bolt to really fit the whole length.

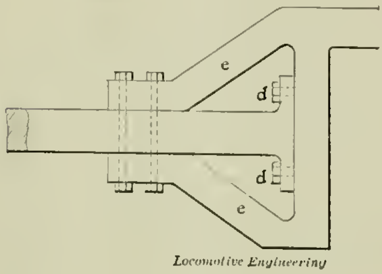


Fig. 3

"To my mind, it's dead easy to see why the inside bolts break first. Just consider the strains, and it seems reasonable that the parts *c c*, being on an angle, will give toward the strain and throw all the strain on bolts *d d*. These let go, and then the long bolts catch it, and it's no wonder frames get loose.

"My scheme is this, and it isn't a new one either, as it has been used in a few instances, with good results—fact is, the idea was given to me by an old engineer who has been watching things pretty closely all his life. Here's the scheme (Fig. 4). Forge the front end of frame as shown, and *A B* and in cross sections, leaving web, say, 2 inches thick, and have the opening about 10 inches wide. Plane the side fits and put in as many bolts as necessary to hold it. These bolts are only 4 inches long under the head (except for the nut), are easily made to fit, and can be got at whenever needed. They can be easily removed or replaced, and this part of the frame need give no more trouble than as though it was solid. Going to turn these down, too, Mr. Duzenbury?"

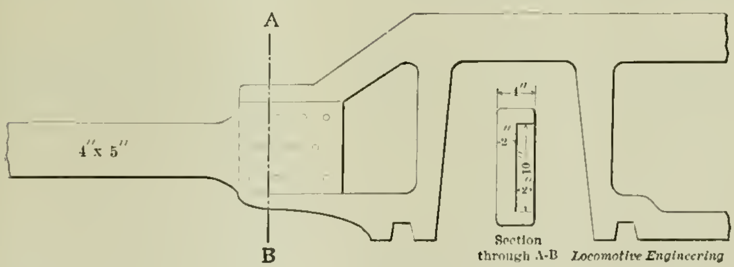


Fig. 4

"Guess not, Philpot; they both seem to be pretty good ideas, and if I ever get a chance to order a new engine, which doesn't seem likely at present, I'll try 'em both. Maybe we can on one of our scraps that will come in to be repaired; but they look reasonable and sensible, and if you keep on getting ideas like these, you'll be holding my job down before many years."

Prof. Coleman Sellers, in a recent talk on the Niagara Power Company's plant, gave a rather startling idea of the immense amount of water contained in the great lakes which supply or feed Niagara Falls. He stated that if there was no more rain, and the lakes were gradually filled up so as to keep the flow of water constant, there was water enough to continue the present flow for 100 years. At this rate we needn't worry about their being run dry while we are wandering around these parts.

Another Balancing Scheme.

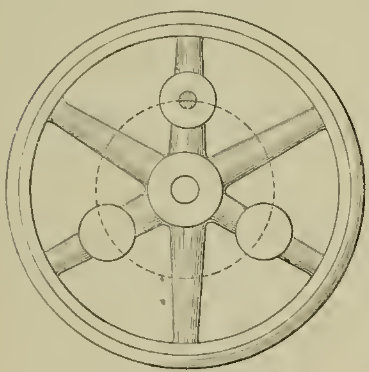
Lest some of our friends should run afoul of the latest balancing scheme for locomotive driving wheels, we make a few extracts from the report of Mr. Wilfred Lewis, in the *Franklin Institute Journal*, on the device:

"It would hardly be worth while to give this more than passing notice, had it not been so persistently entertained and developed, and did it not appear to be gaining credence to a remarkable extent.

"The alleged improvement in balancing a locomotive driving wheel is shown and described in three U. S. patents granted to Philip Z. Davis, March 9, 1897, and numbered consecutively 578,597-8-9. The second patent, the one most exploited, is shown in the figure.

"In all cases the wheels are assumed to be in running balance on their centers, and to the peculiar arrangement of counter weights is ascribed the virtue of maintaining this balance while running on the track.

"It cannot be denied that the wheels,



Locomotive Engineering

BALANCING SCHEME.

balanced as described, will run in perfect balance on a straight track just like any other balanced wheels; but the imputation is that the usual method of balancing is defective, and adopting this fiction as a hypothesis, a curious philosophy is developed to explain a shadow that was never cast.

"The inventor claims a system of balancing by which he obtains a perfect balance for all revolving parts, and an improved balance for the reciprocating parts of a locomotive driving wheel, but his argument is all with reference to the revolving parts, and as nothing is adduced to show any improvement in the balance of the reciprocating parts, our attention will be confined to the revolving parts only. He also claims that, by using two counterweights disposed as shown in the figure, he has overcome the difficulty in balancing locomotive drivers, and his philosophy asserts that any weight attached to a locomotive driving wheel must have its force and effect computed from its true center of rotation, which is the point of contact of wheel and rail for the motion of rotation and translation combined."

Mr. Lewis then proves in his usual clear style that there is absolutely nothing in the claim made, and that it is not a particle better than the usual method.

Monkeying with the Throttle.

We have received the following cutting from a Scranton (Pa.) paper: "Milton Decker, a machinist, who sustained injuries at the Delaware, Lackawanna roundhouse several months ago, died from the result of the same at the Moses Taylor Hospital yesterday morning. Decker was employed repairing a piston from which he had removed the key after taking off the front cylinder head. Some careless person in the cab of the engine opened the throttle, slightly allowing steam to enter the cylinder, loosing the piston from the crosshead and driving it against Decker, pinioning him between the piston and bumper. His injuries were of an internal character mainly. Decker was formerly an engineer on the Lehigh Valley and handled engines on that road during the war under the direction of Superintendent Alex. Mitchell. One day, coming down the mountain side with a heavy train, he was forced to have the brakes applied so hard to prevent the slipping of the train on the bad rail that almost every wheel was flat when he went into the Wilkes-Barre station. This earned for him the cognomen of 'Flat Wheel' Decker, applied to him in a jocose way by railroaders. Later he was injured on the road and abandoned it to work at the machinist trade." The casualty above recorded seems to us to break new ground, so to speak. We have never before run across a similar accident. It shows how fools and meddlers can always be relied upon to trot out something fresh. The only pity is that the evil results nearly always fall on somebody else's head. It is pretty safe to predict that the next man, in this particular district, who uncouples his crosshead for piston examination, etc., will either put somebody to "keep tab" on the footplate, or else tie up his throttle lever.

The Baltimore & Ohio camel-back No. 99, recently dismantled at Grafton, West Virginia, had a war history. This engine was built in 1851, and being in good shape at the outbreak of the civil war, was coveted by the boys in gray and gathered in among other plunder at Martinsburg. It was carried on country roads to Staunton, Va., and made good use of by the grays, finally falling into our hands again by the fortunes of war, and surviving until this year, 1898, going at last to the potter's field, "unwept, unhonored and unsung."

A Heavy Coal Train.

The Pennsylvania Railroad have been making a road test of one of their new H-5 freight engines, the same one as was illustrated on page 273 of our June issue, which shows that they are capable of the heaviest work.

They were built for mountain service, but it was desired to see what they could do on a long run, and the result was entirely satisfactory.

The weights given are estimates, as there are no scales which will satisfactorily weigh such an engine and train, but the estimates are considered to be very close to actual figures.

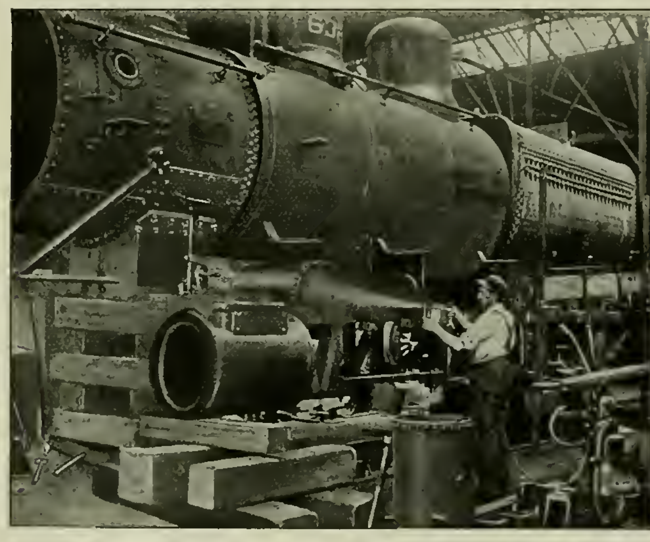
The run could have easily been made in less time, had it not been for detentions not due to either locomotive or train. The weight of train between Altoona and Columbia should be carefully noted, and yet it was considered to be well within the power of the locomotive. The record which follows is due to courtesy of Mr. Theodore N. Ely, chief of motive power of the road.

Record of Experimental Coal Train, Moved by Mountain Helper No. 872, from Altoona to Morrisville, August 9th and 10th:

Locomotive class—H-5.
Cylinders—23½ x 28 inches.
Driving wheels—56 inches diameter.
Steam pressure—180 pounds per square inch.
Weight on drivers—186,000 pounds.
Total weight of locomotive in working order—208,000 pounds.
Weight of tender, loaded—104,600 pounds.
Altoona to Harrisburg—132 miles; maximum grade, 12 feet.
One hundred and thirty cars—5,212 gross tons.
Weight of cars—1,520 tons.
Weight of lading—3,692 tons.
Length of train—3,877 feet.
Time—13 hours 23 minutes.
Harrisburg to Columbia—29 miles; maximum grade, 15 feet.
Time—3 hours 50 minutes.
Columbia to Morrisville—100 miles; maximum grade, 29 feet.
Sixty cars—2,552 gross tons.
Weight of cars—743 tons.
Weight of lading—1,819 tons.
Length of train—1,845 feet.
Time—9 hours.

Painting Machines.

The gradual increase in the use of painting machines operated by compressed air has been marked and of late has been much more rapid. Although generally used on car work, and invariably with good results if properly handled, it is not limited to this field, as the engraving shows.



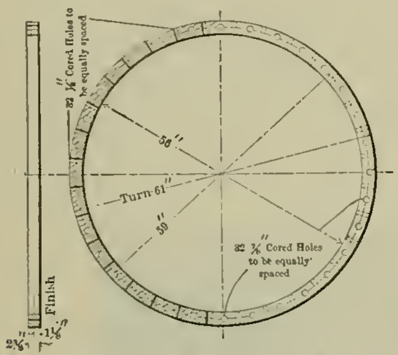
CHICAGO PNEUMATIC PAINTER AT WORK.

This seems to be a new application, or at least one that is not common, and indicates that the possibilities of the machine have not been exhausted. This one is of extremely convenient form and is made by the Chicago Pneumatic Tool Company, of Chicago, Ill.

One of our valued English exchanges is laboring under a misapprehension, when it states in the course of remarks on firing-up systems employed in this country, that "the fact that all boilers in the States are kept full of hot water of course helps those methods of starting the fire, as also does the temporary blower they introduce into the chimney." It is not a fact that all boilers are kept full of hot water; the contrary is more in accord with the actual situation, but the blower is in almost universal use.

Cast-Iron Smokebox Rings.

Mr. Monkhouse, S. M. of the Chicago & Alton Railroad, is successfully using cast-iron smoke-box rings as shown in engraving. All the holes on the edges and sides *a* and *b* are cored. The machine work required is very little, namely, the side next the front end door and the periphery to fit the smoke-box. Even at the same cost Mr. Monkhouse considers the cast ring the best, because the effect from expansion is



CAST-IRON SMOKEBOX RINGS.

less, and there is little or no liability of cracking the cement in joints at front end. The 60-inch cast ring weighs 275 pounds, and, at ½ cent per pound, costs $3.30. Labor finishing, 1¼ hours at 20 cents per hour is 25 cents, or a total of $3.55. If eight or ten could be fitted up at once, they could all be done at one time on a boring mill, which would materially reduce the cost of finishing. The ordinary forged and drilled rings cost all the way from $25 to $50 each on account of the amount of labor involved in finishing.

Small Engines.

A recent booklet of the Baldwin Locomotive Works shows fourteen engines of various types, with gages varying from 2 feet 3½ inches to 1 foot 11⅝ inches. It comes pretty close to a narrow gage booklet, although it is not so called. One of the narrowest gages is an American type, with cylinders 6 by 10 inches; drivers, 23 inches; boiler, 20 inches, and total weight of engine, 12,000 pounds.

Another of the same gage is a six-coupled freight engine, with cylinders 10 by 16 inches; drivers, 33 inches; boiler, 30 inches; total weight of engine, 31,500 pounds. These come pretty near being dwarfs, and it makes a man feel rather dizzy to think of a track less than 2 feet between rails.

A correspondent sends the following clipping: "For preventing a railroad disaster by the timely discovery of a broken rail and the stopping of an approaching train, a locomotive engineer of Halle, on the Saale, received a reward of two marks (50 cents) from the railroad company."

Relative Efficiency of the "Chainless" and Chain-Geared Bicycles.

As many railroad men are bicycle riders, it may be interesting to our readers to know the results of some tests recently made by Professor Carpenter at Cornell University to determine the relative efficiency of chainless and chain-geared bicycles.

By the term "efficiency" is meant the proportion of power applied at the pedals that becomes useful in propelling the bicycle. If the efficiency of a wheel is 80 per cent., then only 80 per cent. of the power applied at the pedals has become useful, and the remaining 20 per cent. has been lost in friction somewhere in the bicycle. The efficiency is equal to 100 per cent., less the percentage of friction.

Friction losses of a bicycle occur in three places, viz.: in the ball bearings of the crank shaft, in the driving gear and in the tires.

The friction of the ball bearings in a high-grade wheel is very small, varying from one-tenth to one-fifth of one per cent. when light machine oil is used, and from five-tenths to seven-tenths when lubricated with a mixture of lard and graphite. The friction is entirely independent of the speed.

The principal objection to the chain gearing is the difficulty of keeping it clean and lubricated. The chain gearing is also unsightly. It has been urged that the chain-gear method of transmitting power is unmechanical and wasteful, but the tests proved that the chain has less friction than is generally supposed, and that it is really one of the most efficient means of transmitting power ever devised. With the chain in good condition, and the bicycle run at a high rate of speed under ordinary load, the efficiency varied from 93 to 97 per cent. A considerable difference was found in the efficiencies of different makes of chains and sprockets, and the degree to which they were affected by mud and dirt. The efficiency of the ordinary chain becomes low when clogged with mud and dirt, or when in need of lubrication. Some forms of chains were found to have nearly as high efficiency when dirty as when clean, and one make of chain had substantially the same efficiency when dirty as when clean. The usual difference of efficiency between clean and dirty chains was from 10 to 15 per cent. One form of sprocket was unaffected by mud and dirt.

The chainless, or bevel-geared means of transmitting driving force from the pedals to the wheel, is not new. Several years ago the method was used to a limited extent, with the hope that it would prove a better means of propulsion than the chain, but it failed to give as good results as the chain. Recent improvements in machinery for cutting perfect bevel gears, however, have greatly reduced the loss of power through friction experienced in the earlier trials, and the present chainless gearing is consequently higher in efficiency; but in Prof. Carpenter's tests there was not a single instance in which, under similar conditions, the friction losses of the high-grade chainless wheel were less than those of the high- grade wheel with chain and sprocket gearing. At fourteen miles per hour, under ordinary load, and with ordinary driving power, the efficiency of the high-grade chainless wheel was 94 per cent., while that of the high-grade chain and sprocket geared wheel was 97 per cent.

Contrary to expectation, the principal friction causing loss of power is found in the pneumatic tire, and greater differences in efficiencies of wheels may be had by simply changing the tires of one make for another. Under a speed of fourteen miles per hour, the efficiency of a certain chainless wheel was 42 per cent. By substituting tires of another make, the efficiency was raised to 54 per cent. Further substitution of still another make raised the efficiency to 60 per cent. This difference in efficiency was found to be greater at higher speeds with greater power applied, and in one test reached as high as 28 per cent.

The deductions to be drawn from Professor Carpenter's tests are these: There is very little loss through friction of the ball bearings, a considerable loss in the gearing and a great loss in the tire. The best chainless wheel does not possess as high efficiency as the best chain wheel. The poorer grade of chainless wheels are not as efficient as the medium grade of chain wheels. The advantage of the chainless wheel lies alone in its neater appearance and dirt-proof encased gearing.

Notwithstanding the rigorously demonstrated superiority of the chain-geared wheel, the chainless, on account of its few and slight advantages mentioned, will gain many friends among persons who get new wheels each year or who blindly follow alleged improvements. In fast racing, however, where every little advantage is sought, it will be interesting to observe whether the racing men disagree with the laboratory tests by adopting the chainless wheel. Meanwhile, the possessor of a high-grade chain wheel can rest assured that in retaining his present mount he will have a wheel of the highest efficiency, and he will not need to make excuses if charged with not being up to date.

The value of good half-tones as a means of showing nature as she really is, minus colorings, is shown in the folder recently issued by the New York Central Railroad, calling attention to its summer resort train service. The view of the "Lost Channel" in the Thousand Islands is enough to make any lover of nature ask for a week off and start the same night.

The Shop Genius.

Every railroad machine shop has its oracle—that is, an artist who is so prolific of resource as to be equal to any emergency, and whose advice "goes" when exit from some one of the numerous holes so easy to get into is desirable. Such a party was "Grumbling Bill," one of the best mechanics that ever killed time in a shop; a man who never tired of helping the cubs over rough places, but one who was at the same time constantly warring with a fate that made him work, whence he got the name of a kicker. We recall how he once saved one of the boys from the wrath of the foreman, in a case of a bushing that required to be a slip inside fit, but had of course been bored too loose.

The usual yarn about callipers getting moved on him had been worn to a gloss with that foreman, and it was useless to formulate any ordinary excuse, everything that had the appearance of plausibility had been worked by the boys too often already, and there was no way out of it, except to take the jacking up or see Bill. He was seen, and getting one hip on the bench for a short rest, he said: "Say, young fellow, it's a pity you're working at this business; if you was a baker you could eat your botches. Go and get that bush to a dull-red heat and shrink it back to where you ought to have bored it." The advice was followed in this instance, and in subsequent cases where the callipers "got moved."

At another time, when a large cast-iron curved pipe required a flange for a special purpose, all the talent of the shop was called on for suggestions, and they were needed, for the place had nothing but the most primitive scraps for tools. Bill did not waste any time in tendering his solution of the problem, and from his seat on driving box delivered himself as follows: "I don't see anything the matter with blocking that pipe up on this 30-inch lathe carriage and clamping the turning and threading tools to the face plate. If you can't swing the job, swing the tool." The thread was cut in accordance with above specification, and a precedent was established in the shop for work that wouldn't swing.

One of the jobs that placed Bill among the immortals in the estimation of the devoted young band of cubs, was a patch put on a bad break in a 17-inch cylinder, in which over one-third of the flange and about 10 inches of the barrel were carried away. It was an experiment to try to patch such a break; but Bill said it could be done, and explained how, and that settled it. Said he: "All you've got to do to make a job of that, is to make a brass patch that fits, and give the bolts plenty of draw in the body and countersink." The patch was put on, but not fully up to Bill's schedule—they failed to get the draw on the bolts; and here was where Bill reached the top of the pedestal builded for him by his admirers. He took hold of the job and placed a thin strip of sheet copper between the scraped joints of the patch and barrel of cylinder, which gave the needed draw, and made a good job of patching.

One more field of labor heretofore regarded as the exclusive property of the whiskered sex is invaded by the fair ones. A street-car line in Chillicothe, Ohio, has "manned" their cars with lady conductors. It is said they are successful, and why not? They are a success from any point of view; but we can't help but wonder about the arrangement of pockets for change. Something had to be done in this important particular, for the old style offered too many obstructions to the lively transaction of business as we know it on a street car. There is no doubt that all difficulties have been overcome by this time, as the genius who could conceive a ten-hour day at $4 per week for the lady conductor will rise superior to a little thing like the arrangement of a pocket.

The Schoen Pressed Steel Company, Pittsburg, Pa., have issued one of the most elaborate catalogs we have seen. Handsomely bound, printed on fine plate paper and illustrated in the latest style, it shows at a glance the development of steel parts for cars. Truck bolsters, body bolsters, steel trucks, underframing, steel flat cars, gondola cars, hopper cars; coal, ore and coke cars, are among the list shown and described. If anyone has doubts as to the real existence of steel cars, this book will convince him of his error. No passenger cars are shown, but after seeing the work of this company, no fear need be felt as to their ability to supply them when demanded.

It is quite appropriate that the cruiser "Buffalo" should be fitted with ventilating fans and engines made by the Buffalo Forge Company, of Buffalo, N. Y. The engines are double enclosed upright type, direct connected to fans, and they run in oil. They have a capacity of 22,000 cubic feet of air per minute at a pressure of 1 ounce. The "Topeka" and several other vessels of the navy have been fitted with this type of fan.

We understand experiments are in progress to make driving wheel tires of compressed paper. A friend claims to have a piece of paper so hard (from compression at 400 tons pressure per square inch) that a diamond cannot scratch it. With paper tires the noise would of course be materially lessened. If these "pan out," as the Klondikers say, there may be a change in tires. In the meantime we will use the best steel we can get.

A correspondent remarks: "Your clipping in August on the big engines for the Santa Fé reminds me that such things are by no means confined to our side of the Atlantic. I remember, some years ago, reading a paragraph in one of the London dailies, commenting on a recent railroad accident. I forget all the wonderful principles therein enunciated, but I remember that there was vouchsafed the information, that a locomotive was so arranged that 'the engineer can alter the length of stroke of his pistons when going round curves, a procedure that not only greatly facilitates, but also conduces to the safety of that operation,' or words to that effect."

The Dickson Locomotive Works have issued a new illustrated catalog of the types of locomotives built at their well-known shops. The half-tone engravings and tabulated descriptions of the engines embrace power for every purpose, from mining locomotives with 7-inch cylinders, operated by compressed air, to the heaviest consolidation engine. The opening pages contain some useful information on tractive power and train resistances, and how these factors are grouped to find the hauling capacity of an engine. The catalog is 6 x 9 inches, bound in cloth, and very neatly gotten up in all particulars.

We have received a very interesting pamphlet on "Mechanical Draft for Steam Boilers" from our friend Walter B. Snow, with the B. F. Sturtevant Company, which contains convincing arguments and data in favor of forced draft as against the old idea of tall and expensive chimneys. If any of our railroad friends are about to be favored with new shops, we would strongly advise that they send for a copy of this before deciding on a chimney.

The Hayden & Derby Manufacturing Company, 111 Liberty street, New York, have issued a very complete catalog of their Metropolitan Locomotive Injectors. This shows the different styles, and also gives the parts separately to facilitate ordering for repairs. There are tables showing the capacities of the injectors under different conditions of feed water and steam pressure.

Lubrication is one of the essentials in high-speed engines, and the latest types of the Buffalo Forge Company's engines show that this is appreciated. These engines run in oil, and have devices for oiling main bearing and for keeping oil cool. Those who need small engines will do well to send for a folder showing these engines.

J. B. Brill & Co. send us a catalog of snow sweepers, snow plows and track scrapers. They evidently believe in taking time by the forelock, and are after business for fighting the coming winter's storms. Nothing like being prepared beforehand.

The Cincinnati, Hamilton & Dayton road, commonly known as the Monon route, have issued a neat little booklet concerning the G. A. R. encampment at Cincinnati, Ohio. It is well written, illustrated with timely pictures, and contains a double-page group of sixteen portraits of the men who are prominent to-day in the army and navy. It is a booklet well worth having.

"Electric Mine Haulage" is the title of a little pamphlet by the Baldwin Locomotive Works and the Westinghouse Electric & Manufacturing Company, showing the application of electricity to mines. It contains considerable information regarding these motors and the load they can handle.

"Electricity for Machine Driving" is the title of a neat little pamphlet of standard size, issued by the Westinghouse Electric and Manufacturing Co., showing the application of electric motors to boring mills, shears, cranes, portable slotters and other tools. There is also considerable data on the question of electric-driven machines as compared with shafting. The Tesla polyphase motor has the advantages of having no commutator and requiring very little attention.

The Imperial Pump Packing made by the Boston Belting Company is giving excellent results in many places. In the Masonic Temple, in Chicago, where the service is particularly severe on the elevators, it is running longer than anything that has been tried.

Brooks Locomotive Works recently made an engine for a logging road in the northwest which had one of the deepest drawheads we have ever seen. There were five pockets for link couplings, the lowest being but 21 inches from the ground. This was necessary to accommodate all of the many different hights of cars to be handled, and made a pretty heavy drawhead.

Bement, Miles & Co. inform us that Mr. Chas. E. Billin's connection with them as representative in Chicago, terminated on August 1st. All communications should now be addressed to Bement, Miles & Co., 1534 Marquette Building, Chicago, Ill., and will receive prompt attention.

The Modern Roundhouse Turntable.

The economics of railway management do not end with the adoption of the high-pressure compound locomotive, or the hundred other contrivances which have been born of necessity, but go on and on, always finding a way to eliminate here or there an unnecessary expenditure.

The latest economic development is the adaptation of the electric motor to turntables, called the Westinghouse turntable "donkey." The simplicity of the device and the method of operating it are plainly evidenced in the illustrations.

It is the product of the Westinghouse Electric & Manufacturing Company, and consists of their "series reversible" ten horse-power motor, mounted within a heavy cast-iron frame, having a traction wheel which rests upon the rail of the turntable pit. Power is transmitted to this wheel through double reduction gears. The "donkey" frame is connected by draw-bar and pin to one end of the turntable at the side, sufficient traction for the driving wheel being secured through the weight of the machine, which is 3,700 pounds. Wires are run from the "donkey" to a small platform, located at one side of the center of the turntable or other convenient place, at which point is installed a controlling rheostat. By means of this controller the "donkey" may be operated in either direction, and its speed controlled at will by simply moving a single lever to one or the other side of a neutral point. Current, which may be supplied from the shop lighting or other convenient circuits, and may be either alternating or direct and of any standard voltage, is supplied by wires brought to a suitable contact overhead and then led to the controller.

As no changes in the turntable are required for installing the turntable "donkey," the connections between frame of the latter and the turntable girder being very simple, the cost of installation is low.

As compared with the steam operated turntable, it is apparent, even to the layman, that electrical power has the advantage, as it is a well-recognized fact that the small portable boiler and engine are extremely wasteful of fuel, besides being a source of danger and requiring constant expert attention.

The comparison with turntables operated by push poles is no less interesting. In one of the installations, located at an important division point, it was necessary to turn 176 engines each 24 hours, or about seven per hour. Previous to installing this "donkey," push-poles were used, requiring the services of four men, and the operation was a slow one at best. Now one man does the work in a much shorter time. With turntable "light," the "donkey" will make a complete revolution in 30 seconds, while with a ten-wheel locomotive on the table, weighing, with tender, 100 tons, a complete revolution is made in 45 seconds. We therefore have the following summary:

Engines turned per day........	176
Men required....................	4
Average time, each man........	5 min.
Total time per engine (5 min. x 4 men)....................	20 "
Total time for 176 engines.....	59 hrs.
Total time for 176 engines, with electric "donkey"...........	24 "
Time saved..................	35 hrs.
Thirty-five hours at 12½ cents, amount saved per day.......	$4.37

The above calculations assume that the men are employed in wiping engines while not employed in operating turntable; otherwise the comparison would be still more favorable to electrical operation.

The assumption of five minutes per man on the average is conservative. It is plain that the 35 hours saved would supply two day and two night men as wipers on shifts of eight hours each.

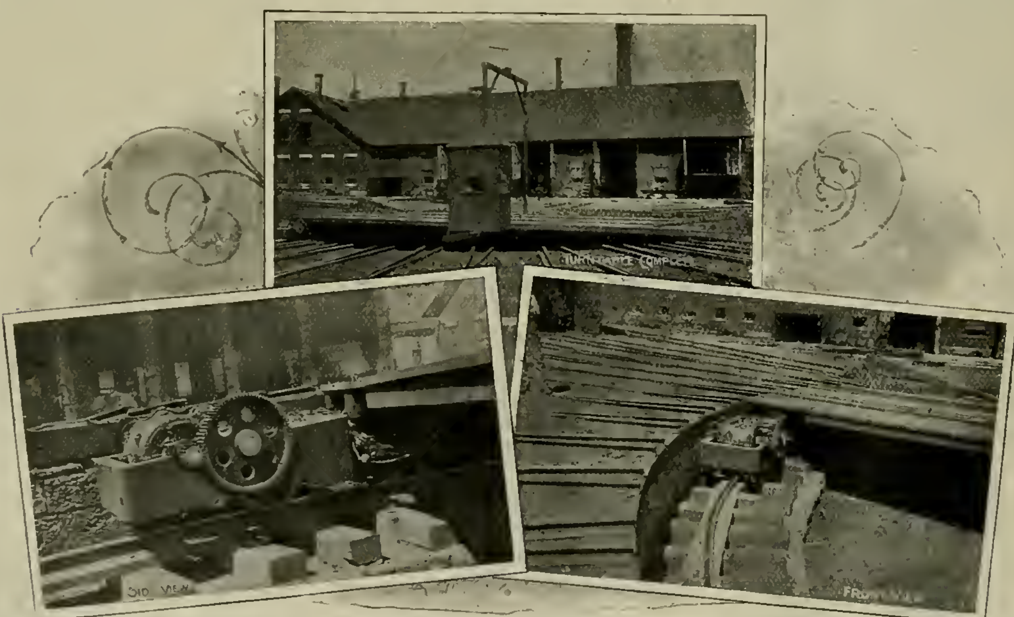
It is stated that actual tests have shown that the power consumed by the electric "donkey" is the equivalent of a half horse-power per hour. Assuming 6 pounds of coal per horse-power, with coal at $2 per ton, the cost of turning each locomotive would be 3-10 cent, or 53 cents for 176 locomotives.

The sales of the Chicago Pneumatic Tool Company have been little less than phenomenal for the past few months, seventy-eight machines of various types being ordered in one day, and four of this lot going to China. The Japanese Railroad also ordered six machines, which indicates that their popularity is extending abroad.

The Newton Machine Tool Works are about completing the largest cold saw cutting-off machine for steel castings that has ever been built. This machine is for the Bethlehem Iron Company, and will weigh about 70,000 pounds without the bed plate. The machine carries a saw 60 inches in diameter and is adjustable both vertically and horizontally, and will cover a range of work within a square or parallelogram of 8 feet in hight and 20 feet long, allowing a steel casting to be clamped to the bed plate and cut off the entire series of heads within this range without moving the work. They have also recently furnished the American Steel Casting Company two large saws for their risers and two saws to the Standard Steel Works, at Burnham, for their steel casting risers.

We are informed by the Standard Coupler Company that their Standard Steel Platform, which has only been on the market sixteen months, is now in use on forty-three railroads. This certainly speaks well for its value.

The Joseph Dixon Crucible Company, Jersey City, N. J., are now placing on the market a solid belt dressing in round bars, about 8 inches long and 2 inches diameter. It makes a package convenient to the hand, and easy to apply even to fast-running belts. The company does not claim that the solid dressing is as good a preservative of the life and elasticity of the leather as the Dixon paste, but it is quick to apply and quick to act, and that is what is wanted by the general run of belt users.



ELECTRIC MOTOR ON TURNTABLE.

The Noxall Spiral Packing for piston and valve rods is gaining many friends among railroad men. It is soft, durable; is free from grit and acid, and successfully withstands the high steam pressure of today. Made by Boston Belting Company, Boston, Mass.

LOCOMOTIVE ENGINEERING
A PRACTICAL JOURNAL of RAILWAY MOTIVE POWER AND ROLLING STOCK.

Vol. XI. NEW YORK, OCTOBER, 1898. No. 10.

From the Thames to the Volga.

[EDITORIAL CORRESPONDENCE.]

Nijni Novgorod, Russia, July 27, 1898.

It is customary, I believe, for those who write "tales of travelers" to begin by giving the impressions on the way that have struck them most forcibly. I shall follow that example.

We have traveled about 2,500 miles from London through civilized countries in the harvest and haying time, and we have not once seen a reaping or mowing machine, neither have we seen any fields which bore the stamp of those useful machines. In many places the grain crop seemed to be dead ripe, and a year's saving in loss of grain would probably have paid for a good harvester. British crops were not ripe or we should have seen machines at work in their fields.

Another curious thing noted on the journey was that while we stopped off at Liverpool, Manchester and London, while we were on trains that stopped in all the great cities between Ostend and St. Petersburg and made some stay in the latter city and Moscow, we saw no electric street car until we were in Nijni-Novgorod, which is 270 miles east of Moscow, and is as far east as Aden on the Red Sea. It looks from that that the ideas of progress are a little mixed. Another anomaly is that near this eastern city, the most easterly manufacturing city in Europe, I found what I believe to be the best equipped works in Europe for the manufacture of locomotives. That remark, however, applies to the end of the story, and I might as well tell it consecutive'y from the beginning.

We left London on July 21st—that is, Mr. W. D. Sargent and the writer—bound for Russia by the Nord Express. The route is from London to Dover by rail, thence to Ostend by an express steamer, and the remainder of the journey to St. Petersburg by what is justly getting known as the famous Nord Express. There was nothing notable in the run from London to Dover. It was an ordinary express train with old-fashioned cars, but it whirled us through the vales and hop gardens of Kent at about forty-five miles an hour. There were so many pretty scenes to talk about that the chalk cliffs of the English Channel loomed up before we seemed well started. The train reached Dover only seven minutes late—quite an unusual fit of punctuality. Then everybody, with bag and baggage, was hurried

VIEW OF MOSCOW.

on to a remarkably handsome paddle-boat, which lost no time in rushing away to Ostend, in Belgium. The speed made was over twenty-four miles an hour. As this speed was made over a cross-running sea, it made the boat roll worse than the waves of the Atlantic, and made people sea-sick who had crossed the big ocean with impunity. My friend Sargent was among the most lively passengers on the Britannic, but we had scarcely started from Dover when he sought the seclusion of our cabin and reclined in a pensive mood until steam was shut off at the entrance of Ostend harbor.

The packet boat referred to belongs to the Belgian State Railways, which inaugurated the Nord Express, a "train de luxe" which carries passengers from London to St. Petersburg twice a week in fifty-two hours. The distance is about 1,700 miles, so the train is remarkably fast for the continent of Europe, when we consider the time lost crossing the English channel, the delays at frontiers and the numerous stops for wood and water. I saw no engines equipped with means for lifting water while running.

State railways are nearly always notorious for the bad management that produces slow, unpunctual trains, uncomfortable cars and annoying rules. The Belgian State Railways form a striking exception in that respect. There are hustlers in charge, and the manner of advertising the advantages that passengers enjoy traveling over these lines reminds us of the pushing methods pursued by Daniels, of the New York Central.

A pamphlet in English, setting forth the attractions of the Belgian State Railways, has some droll paragraphs which may give some of our car builders and car-seat makers new ideas on car construction. One page reads:

"The rolling stock used by the Belgian State Railways in the international trains running in connection with the mail service between Ostend and Dover, is conspicuous as regards comfort. This rolling stock is made up of carriages on three axles and of carriages on bogey wheels; all the carriages are provided with W. C., steam-heating apparatus and the quick-acting Westinghouse brake.

"The carriages on three axles, six-wheeled, travel very easily; one leaves them after the longest journeys without feeling the least fatigue. The reason is that the Belgians have very different ideas from the Germans and Dutch as regards building traveling cars.

"The latter named make the seats very yielding and put exceedingly flexible springs under the frames, and in this case the body of the carriage rests directly upon the iron framework.

"The Belgians put into their seats springs only slightly flexible; on the other hand they have a double disconnection between the body of the car and the iron framework either by means of spiral springs or by strong rubber plates.

"The Dutch-German system has the advantage of at first making a very pleasing impression upon the traveler, as he sinks into the very soft seat.

"In the case of travelers who for the most part travel only short distances which are but slightly fatiguing, this good impression lasts, and it is by no means rare to hear these carriages praised.

"But where long journeys are concerned, this system is one of the least to be recommended. Its defects, however, appear as soon as one examines rather closely the conditions under which the traveler journeys.

"His feet rest upon the floor, which, as we have said, lies directly upon the iron framework; his body, on the other hand, seated upon a very flexible seat, sways continuously; as his feet remain firm and his body is continually shifting about, it follows that far from being at rest, all the muscles of his legs are ceaselessly in motion; besides this, when one leans against the back of the seat, the motion of the chair produces friction between the traveler's back and the stuffing, which greatly fatigues the whole body.

"As in the Belgian system the springs are placed throughout almost the entire part lying beneath the frame of the carriage, this latter is held in an easy suspension, and carries the traveler gently without giving rise to any movement of his body, and consequently no fatigue is entailed.

"The rolling stock on the bogey system used by the Belgian State Railways is still better as regards its 'running.' The framework of these cars being entirely of wood produces in them an incomparable elasticity and gentleness of movement. (Easy running.) The absence of noise enables one to carry on a conversation as easily as if one were in a drawing-room.

"The directors of the Belgian State Railways might be reproached for having aspired to elegance and luxury in a less degree than have other railway companies. But in this respect the state of affairs is now changed; new carriages have been built, and travelers now find at Ostend carriages on bogey wheels, which surpass the finest carriages now in use both in comfort as well as in richness of decoration.

"The railway itself has recently been renewed with rails of an entirely modern type, and very powerful engines are used. All this has brought about a great reduction of time in traveling between London and the principal towns of the Continent, and has enabled travelers to make their journeys with speed and comfort."

Our train, the Nord Express, was of the "corridor" kind; that is, it had vestibules between the cars and a through passage at the side of each car. It consisted of two sleepers and a dining car, each about 60 feet long; a mail and a baggage car, each about 30 feet long. The sleeping cars were arranged in small compartments, each containing two single beds. There are nine compartments in each car, giving accommodation for eighteen persons. The cars rode well and "carried the traveler gently," as the circular remarks, and provided very comfortable quarters for a long journey. The cost of traveling in these trains is more than double what the same accommodations would be provided for in America.

There is an impression that living in European hotels is cheap. We found that they were very dear, and by no means comfortable. After you have been nearly bankrupted by the bill, an avenue of

PRINCIPAL STREET IN ST. PETERSBURG.

lackeys await you at the door, holding out their hands. By the time you get clear away you feel in the place of Mark Twain's traveler who exclaimed, "If there is any man, woman or child in this place whom I have not tipped, let him stand forth."

One of our small methods of amusement during the journey was going out and watching the change of engines. They changed about every hundred miles, so we had quite a variety of locomotives pulling the train. The drivers of all the engines we managed to talk to said the train pulled very hard. It weighed only about 150 tons, but the speed had to be maintained above fifty miles an hour.

The engine that took us over the first division had a peculiar form of firebox. The front part was of the common rectangular section, but behind the back driving wheels it was extended over the frames, giving a material increase of grate area. The coal was the finest kind of bituminous slack, but the driver said that the engine steamed quite freely with it.

We found great variety in the character of the fuel burned by the different locomotives. On the whole of the journey on the Continent I did not see a single tenderful of coal that would have satisfied a self-respecting American locomotive engineer—slack and coal pressed into bricks or mixtures of coal and peat pressed together. In Russia wood was the most common fuel, but east of Moscow it was petroleum. The firewood used in Russia is birch, and it goes through the stack with great velocity. Two men are kept pretty busy feeding the firebox.

This train introduced us to the greatest variety of tongues I had ever listened to. In the dining car you would hear orders shouted in English, French, German, Polish, Russian and other strange tongues. Those who had to depend upon English fared the worst. We were assured that the porters spoke French, German and Russian; but their knowledge of the first two tongues was exceedingly small. Our plan, when ordering anything, was to bombard them with a double ammunition. Sargent would hurl a phrase in German, and I would follow it up by an assault of French. Between that and a phrase of strong English thrown in occasionally, we continued to keep above starvation. The seances in the dining car were generally very much prolonged, because it was amusing to hear the kinds of conversation going on and the misunderstandings between the passengers and waiters.

KREMLIN, MOSCOW.

This was quite a relief, for the greater part of the journey was very uninteresting, so far as outside attractions are concerned. The journey through Belgium and the west of Germany is interesting enough, but when we got five hours east of Berlin the country becomes poor and monotonous, and there is very little change as far as we have come.

The trip through Belgium is particularly interesting to those who enjoy looking upon fertile fields, thriving towns and bountiful fruits of industry. The country supports a dense population because the fields are tilled like gardens and are alive with men, women and children. All seem to be busy, and even the domestic dog is not permitted to rest in idleness. He is harnessed to a cart and pulls the country produce to market.

Throughout a great part of Germany are to be seen large tracts of land devoted to the raising of beets, from which sugar is made. We learned that this industry is suffering from the effects of the Dingley tariff bill, which militates against bounty cultured sugar.

Traveling develops dislike to tariffs and the entailed restrictions put upon people in passing from one country to another. The customs officers of some European countries are senseless in their system of inspection, and brutal in the way they do the work. We were on a through train passing merely through Germany, yet the customs officers at the frontier station pulled all the stuff out of my bags, and treated the other passengers in the same fashion. Just pulled the things out upon the bench and left them there. A case came to my notice, of a gentleman who left home with a trunk which his wife had packed. The German custom house officers tumbled all the things out and shook

INSTITUTE OF ENGINEERS, ST. PETERSBURG.

them out of fold; then when the owner tried to repack them, he had half a trunkful of clothes over. Had to go away with the overflow tied with a rope.

The Russian custom house officers treated us very gently, so far as examination of baggage was concerned. Passports are their formidable weapons of offense. Experience had taught me to beware of violating Russian passport regulations, but my companion was deficient in highly important information on this point.

He had provided himself with a passport, but was not aware that the visé of a Russian consul is necessary to make it of any value. When we arrived at Wirballow, the Russian frontier station, Sargent's passport was declared defective, and he was turned back. It was necessary to return to the nearest town where there was an American consul, and that was Koenigsberg. He went back to Koenigsberg, and finding the American consul absent, he tried to get the Russian consul to visé the passport; but that official refused to do so, until he should receive assurance from the American consul that the bearer of the passport was not a Jew. The American consul was away at a watering place on the shores of the Baltic, and thither Sargent had to follow him. The American consuls in some places have very loose ideas concerning their official duties, for in this case the office was left without one authorized to perform the duties. When Mr. Sargent found the wandering consul he turned out to be a very pleasant Hebrew, and he readily indorsed on the passport that the bearer was a Christian. That opened the Russian official door, and my traveling companion was duly passed in and reached St. Petersburg two days after I had got there.

A. S.

MARKET AND CHURCH, ST. PETERSBURG.

Caught at His Own Game.

One of the traveling engineers told us a good yarn about a master mechanic who was examining a fireman for promotion. He was on deck with all his answers (probably a regular reader of LOCOMOTIVE ENGINEERING), and finally this one was fired at him.

"If your engine had just managed to crawl up over a heavy grade and on breaking over the top your engine, having hardly any water in her tipped over, what would you do?"

"Use the slice bar and get the fire out of her p. d. q.," came the answer.

"But the slice bar is under the tank my friend," grinned the master mechanic.

"Well, I'd get out of it someway," said the victim; "never got stuck yet, sir."

"Why not take the shovel and put dirt on the fire," smiled the inquisitor.

"Well, Mr. Jones, that's a scheme I hadn't thought of, for I thought the shovel would be under the tank with the slice bar."

MOSCOW—BREST RAILWAY STATION.

The Grand Trunk Railway has one feature about its stations that is appreciated by travelers in the shape of having the name of the stations on each end instead of in front. By this means a passenger can readily see the name of the place even in passing at a good speed, while, with the sign in front it is generally impossible. It probably does not add materially to the receipts of the roads, but it is a gratification to its patrons and a benefit to the towns.

Under the title of "Quarter of a Million Horse-Power of Polyphase Electric Transmission Apparatus," the Westinghouse Electric & Manufacturing Company have issued one of the most artistic booklets we have seen. The cover is in colors, and the half-tone illustrations are excellent. It contains a list of installations of this kind of apparatus, which shows its use to be more general than might be supposed. The list comprises many factories, which shows that it is applicable to railroad and other shops.

"Monkeying with the Throttle."

Under this heading last month we mentioned an accident to Milton Decker, of Scranton, which resulted in his death. It was said to be due to someone opening the throttle and driving the piston against Decker.

We then proceeded to deliver a little sermon on the evils of allowing any monkeying of this kind, which seemed to be timely. The sermon was all right, too, if we do say it; but the trouble is it didn't fit, because the whole thing was a newspaper yarn—a yellow one at that.

Master Mechanic David Brown writes us that the man died from malignant diseases of the stomach, and sends a hospital certificate to prove it. He also remarks that they are very careful about such things, and allow no one to move an engine except those whose duty it is to do so.

We are glad to know the truth of the matter and to absolve Mr. Brown from any apparent blame, as we always want to do justice to everyone.

Railways in Porto Rico and Cuba.

We are having numerous inquiries from readers who seem anxious to know of every new opening or prospects of obtaining better positions, about the railroads of our new possessions and of Cuba. While our information is not as full as might be desired, we are able to give a list of the roads according to the latest reports, although some of the officials in Porto Rico may have suddenly remembered urgent calls to Spain.

Statistics show three roads in Porto Rico; the longest, called the Porto Rico Railroad, being 126.8 miles long, having twenty-five locomotives, thirty-two passenger and 320 freight cars. It also owns one steamboat. The next in size is the San Juan to the River Piedras, which is 6¾ miles long, has six locomotives, sixteen passenger and thirteen freight cars. The gage is 30 inches. The number of cars and engines seem entirely out of proportion, but there is probably some good reason for it. Last comes the Western Railroad, which is only 4½ miles long, has three locomotives, seven passenger and twenty-five freight cars and two steamboats. This and the first road are one meter gage, or 39⅜ inches, very nearly.

Cuba has, or had, fifteen railroads, twelve of which are standard gage. These are the Caibarien, 37¼ miles long, with nine locomotives, twelve passenger and 196 freight cars. This road also has 24¾ miles of 3-foot gage, having nine locomotives, eight passenger and 245 freight cars.

The Cardenas y Jucaro is 211 miles long, has forty-nine locomotives, forty passenger and 1,130 freight cars. Passenger traffic is evidently not very heavy.

The Cienfuegos-Santa Clara is 64½ miles long, with twenty locomotives, twenty-three passenger and 455 freight cars.

Cuba-Sabanilla-Maroto has, or had, its headquarters at Santiago, and consists of 38 miles of road, four locomotives, ten passenger and thirty-four freight cars.

The Guantanamo has 22½ miles, seven locomotives, seven passenger and eighty-one freight cars. This recalls another incident of the Cuban campaign.

Los Tunas a Sancti Spiritu has 24¼ miles of track, four locomotives, five passenger and thirty-seven freight cars.

The shortest road is the Mariano & Havana, which is only nine miles long; but it has five locomotives, twenty-three passenger and thirty-five freight cars. Next comes the Urbano road, 12½ miles long, with eleven locomotives, sixty-seven passenger and only five freight cars. This must be a passenger road almost exclusively.

The Matanzas road is 170 miles long, and the city is famous for the alleged killing of a mule during the bombardment. It has forty-seven locomotives, twenty-nine passenger and 1,070 freight cars.

The Santiago road is 34 mi'es long, has seven locomotives, eighteen passenger and eighty-two freight cars.

The longest road is the United Railways of Havana, which has 227 miles of track, seventy-eight locomotives, eighty-nine passenger and 1,819 freight cars. It has also a branch of eleven miles of 30-inch gage, with three locomotives and fifty-four passenger cars.

The Western of Havana is 110 miles long, has nineteen locomotives, twenty passenger and 237 freight cars.

The Sagua la Grande has 70 miles of standard gage, with twenty-three locomotives, twenty-one passenger and 546 freight cars. They also have nine miles of 30-inch gage, with three locomotives, two passenger and forty freight cars.

The odd-gage roads are the Gibara and Holguin, having 18¾ miles of 3-foot gage, three locomotives, four passenger and sixteen freight cars; also the Puerto Principe y Nuevitas, with its 45¼ miles of 5-foot gage, ten locomotives, eight passenger and ninety-three freight cars.

This shows a total of 138¼ miles of track, thirty-four locomotives, fifty-five passenger and 350 freight cars for Porto Rico, to say nothing of the three steamboats.

Cuba shows a much larger total, owing to its having so much more room to put the railroads. It has 1,139 miles of road, 311 locomotives, 440 passenger and 6,121 freight cars.

When things get to moving again these will probably all expand, and should be a good field for business, always remembering the climate and its effect on strangers.

Steel Ties.

Wooden ties are said to have practically disappeared from the Mexican railway. Steel ties have been in experimental use since 1884, and General Manager Foot is satisfied that they are good for some fifty years, while wood lasts perhaps four years. Steel ties at present cost about $3 Mexican money—less than $1.50 gold—or double the cost of wood, but the far greater life and the saving of renewal work indicate very great economy in their case. This road had 500,000 steel ties in service when I was there, leaving about forty miles yet to lay, and the piles of the trough-shaped steel plates scattered along the line indicated that the work of complete equipment would soon be finished. They are being introduced on most of the roads there, and it is claimed that the cost of maintenance is reduced, as well as a better track secured.

SLEIGH RIDING IN RUSSIA.

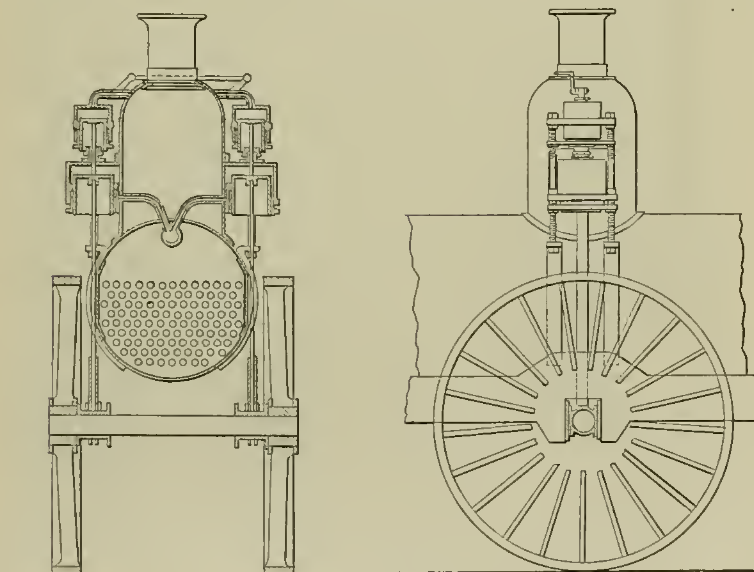
A railway man in Australia, who bought a copy of "The World's Rail Way," writes that it is the most beautiful book he has ever seen, and that it is as interesting as it is handsome. The war "Extra" had a very depressing influence upon the sale of books, and we still have a good many copies of "The World's Rail Way" waiting for buyers. Price $7.50.

Forgotten Facts in Railroading.

There are many interesting facts in connection with the various details of railroading which have been overlooked or forgotten, and which will be new to the younger men as well as to many who are not so young as they might be.

Among the early builders who left an imprint on the American locomotive, Ross Winans, of Baltimore, stands pretty near the top of the list, and some of his early devices were ingenious and bold methods of accomplishing his ends.

His throttle valve, by the use of eccentrics, was easily opened and stayed put, and we believe the use of a similar device would be much simpler and more effective than many of the toggles used to-day for accomplishing the same result. The eccentric gave a good leverage to start



Locomotive Engineering

ROSS WINANS TRACTION INCREASER.

the valve with, and also allowed a fine adjustment of opening if desired.

Some of the things not usually found in locomotive practice and which were on the "Winans Camel" are as follows:

The boiler was straight, and had a dome of nearly the same diameter as the boiler. The firebox was extended back of frames, and had a combustion chamber formed by the front sheet, being slanted from the bottom of the flue sheet to about 10 inches of the firebox, which was perpendicular. The top of firebox was flat and stayed to crown sheet in same manner as the sides were, i. e., screw staybolts. It contained three flue sheets. The one in the middle was for the purpose of supporting the flues, and lacked a little of coming to the bottom of the boiler; this allowed the water to circulate from one section to the other.

Frames were made of iron plates of sufficient width to form the pedestals, distance pieces being placed between the plates and held together by riveting. The shoes for the driving boxes were also riveted in to the frame plates in the same way.

The driving boxes were without wedges, except the main ones, which had one wedge each. The springs were between the two plates of the frame, and each end of them rested on top of a driving box, while the center was held by a bolt forming a fulcrum, making the springs act as equalizers and springs at the same time, which made a fairly good riding engine.

The cylinders were bolted to the side of smoke arch, which was square at the bottom, and the same bolts held the frames in place. At the bottom of cylinders there was a small port that was covered on the lower side by a safety valve (one of these at each end of cylinder), and the valves were held up by a half elliptic spring of proper length to let the ends of it rest on the valve. This was for the purpose of allowing the water to escape without injury. Each front cylinder head had six hand-hole plates for the purpose of adjusting the cylinder packing without taking off the cylinder head, spring packing being used. The steam chest cover formed a part of the steam chest making the joint at the center line of the valve stem. One steam pipe in the smoke arch came down to a level of the steam chest, where it branched out horizontally to connect to the steam chest. The exhaust from each cylinder came together into a box with movable sides to form a variable exhaust, the sides being operated by crank connecting bevel gears to a worm shaft in the smoke arch.

The throttle was a slide valve on top of dry pipe, well up to the top of the dome, with stem coming through a stuffing box in side of dome. An eccentric was connected to the stem, and to a shaft operated by two cranks, one each side (for full particulars of valve motion see LOCOMOTIVE ENGINEERING, page 185, October, 1890).

The pumps were located on the sides of the firebox, and were all cast iron, which includes the discharge pipe, which was attached to the side of the outside sheet of the firebox. These pumps had only a receiving and discharge valve, and no boiler check. The hose was attached to the neck of the bottom chamber. The pump plunger was driven either from the crosshead or arms on the front end of the main rod. The main rods had straps with gib and key only to hold it, there being no bolts; side rods all solid ends, and no knuckle joints, each rod being independent. The guides were a single square bar, and crosshead was of cast iron, made in two parts, divided vertically, each part having one-half of the pin for main rod. The two parts were bolted firmly together and piston rod keyed in. The oil cups on the steam chests were made of the plug cock type, having a large plug which was cored out nearly its full length, and only one opening into this chamber. When

Locomotive Engineering

WINANS TRUCK SPRING.

the plug was turned to fill the chamber with oil, the steam was shut off from the chest, and when the plug was given one-half a turn, it opened the passage from the chamber to the steam chest and closed it to the atmosphere.

The tenders were carried on eight wheels, and the housings for the journal bearings were bolted to the ends of a long half-elliptic spring, which formed the truck frame. The tender was three stories in hight, i. e., there was a basement, or "pit," for the fireman to stand in while firing; the main floor for the coal, and a garret for the purpose of filling the chutes that were on top of the firebox. There were many other things of minor importance, besides many not mentioned because they are shown more or less fully in the pictures.

One of his devices is shown with this, which he patented December 2, 1851, and has been revived at various periods. It is for temporarily increasing the weight on drivers (and the adhesion), so as to enable a heavy train to be started with ease. This was done by admitting steam to the cylinders over the drivers, which relieved a portion of the weight from the trucks, throwing it on the drivers. It was not unlike Stephenson's "steam springs," although for an entirely different purpose. The wheel base of the engine shown, as well as the truck springs, are also interesting.

Richmond Compound for Canadian Pacific Railway.

One of the latest compounds turned out by the Richmond Locomotive Works is that shown by the accompanying engraving. Some of the details follow:

Weight on drivers—126,300.

Weight on truck wheels—16,350.

Weight, total—142,650.

Wheel-base, total of engine—22 feet 6 inches.

Wheel-base, driving—14 feet 6 inches.

Length over all, engine—36 feet 10 inches.

Heating surface, firebox—151 square feet.

Heating surface, tubes—1,845 square feet.

Heating surface, total—1,996 square feet.

Grate area—32.7 square feet.

Valves, outside lap—H. P., 1 inch; L. P., ¾ inch.

Valves, inside clearance—H. P., ¼ inch; L. P., ⅜ inch.

Boiler, working steam pressure—200 pounds.

Boiler, material in barrel—Worth Bros. steel.

Boiler, thickness of material in barrel—⅝ inch.

Boiler, diameter of barrel—62 inches.

Thickness of tube sheets—½ inch.

Thickness of crown sheet—⅝ inch.

Crown sheet stayed with—1¼-inch staybolts.

Dome, diameter—28 inches.

Tank, capacity for water—3,800 gallons.

Coal capacity—8 tons.

Diameter of truck wheels—33 inches.

Diameter and length of journals—4¼ x 8 inches.

RICHMOND COMPOUND FOR CANADIAN PACIFIC.

Drivers, diameter—51 inches.

Drivers, material in centers—Cast iron.

Truck wheels, diameter—30 inches.

Journals, driving axles, size—8½ x 10 inches.

Journals, truck axles, size—5 x 8 inches.

Main crank pin, size—7 x 4 3-16 inches and 6¾ x 6 inches.

H. P. cylinder, diameter—20¼ inches.

L. P. cylinder, diameter—32 inches.

Piston, stroke—26 inches.

Piston rod, diameter—3 11-16 inches.

Steam ports, length—H. P., 20 inches; L. P., 23 inches.

Steam ports, width—H. P., 1½ inches; L. P., 2¼ inches.

Exhaust ports, length—H. P., 20 inches; L. P., 23 inches.

Exhaust ports, width—H. P., 3 inches; L. P., 3 inches.

Bridge, width—H. P., 1¼ inches; L. P., 1¼ inches.

Valves, greatest travel—H. P., 5½ inches; L. P., 6 inches.

Grand Trunk Shops, Toronto.

Mr. William Trumbull, general foreman of the Grand Trunk shops at Toronto, deserves to be congratulated on the general appearance of the shops under his charge. Everything is neat and clean, whitewash being used liberally, being, of course, put on by compressed air.

A narrow gage shop railway connects the different departments and also the roundhouse with the shop. The switches are controlled by a compressed air device, a little rod projecting half an inch above the floor being all that is visible. A slight movement of the foot throws the switch as desired.

Air hoists abound and overhead track supplies every tool and every part of the shop with appliances for handling material and not breaking a man's back.

Mr. Trumbull is doing considerable switch work at present, and has many ingenious devices for getting work out in a hurry and having it right too.

It was particularly gratifying to see his system of getting out switch stands. He has jigs for every part, even the base, and as a consequence, they are not only thoroughly interchangeable, but they are turned out rapidly and at lower cost than is possible in any other way. Thorough system seems to prevail with its attendant benefits.

The new passenger train of the Great Siberian Railway has among its special features for the comfort and enjoyment of passengers, a barber who is up in "the ills flesh is heir to" and can prescribe medicines on occasion. Is it possible they are drifting to the practice of early days, when the barber pursued the dual calling of shaving and bleeding? The wheel fiend should be in his element on this train, which has a stationary bicycle with all the mechanism for automatically registering the time used, distance traversed and work done, while the performer is taking his scorch aboard the train. Verily, they are approaching the limit of luxury on these trains running through the wastes of Siberia.

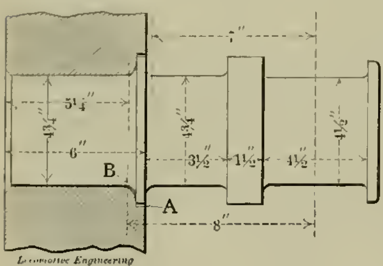
The car of the International Correspondence School was at Toronto during the convention and attracted considerable attention among the boys. It has been all remodelled—has about all kinds of apparatus, including air-brake valves, diamond "S" brake shoes, Nathan lubricators, etc., etc. They have just inaugurated a new course especially for locomotive engineers and firemen, which has much to recommend it

A Cause of Crank-Pin Failures.

While the quality of material for crank pins is of the greatest importance, a phase of the subject that should be kept in mind is, correct design. That this is true is seen when pins of the best material for the purpose break without apparent cause. Wrought iron and steel of a test strength far in excess of the calculated stresses in the pin, fail, and as a last resort the diameter is increased. In many such cases the fault is not with the material, but is in the mechanical work on the pin at the wheel fit.

The weakening due to design is found in two places, and the two most vital points on the pin, namely, at *A* and *B* in the engraving, which shows the main pin of a six-wheel connected engine, and has the dimensions of a mogul and ten-wheeler that caused much annoyance and expense for renewals of pins before the discovery was made that the design and fit were wholly at fault, and material of the pins had no bearing in the case, except in the longer life of steel over iron.

A reference to these weak points shows the collar of the pin at *A* of a less diameter than the counterbore it should fill, and the fillet on the pin at *B* is also smaller than that in the wheel hub. This bad work is the result of design and not chance; the aim of the man that made the fit being plainly to have the pin clear at those points, and be sure of going to the shoulder on the collar without binding on a fat fillet or a collar too large, and thus necessitate the removal of the pin to be eased—an operation that would reflect on his ability with the calipers, and the pin is made too small at the very places they should fit.



CAUSE OF CRANK-PIN FAILURES.

Of the two fits, however, that at the collar is the one that prevents trouble, rather than that at the fillet, because if the former is a press fit in the counterbore, the latter may be away from the wheel, as shown, and not affect the strength of the pin; but if the collar is not a tight fit, then the size and fit of the fillet become factors in weakening the pin, by increasing the lever arm through which the load acts to cause rupture—that is, from 7 inches, the distance from the center line of cylinder to the root of the fillet outside of the collar, to 8 inches, which is the distance to root of the inside fillet. In this instance it is seen that ¾ inch of fit was uselessly sacrificed where it was most needed.

The effect of this inexcusable resultant increase of stress is apparent in the bending moments, which, with the boiler pressure of 150 pounds on the 18-inch piston, equalled, in the case of the shorter arm, $38,000 \times 7 = 266,000$ inch-pounds, and for the longer one, $38,000 \times 8 = 304,000$ inch-pounds. Since the pin is of the same diameter at the points considered, the moment of resistance is the same for both, and dividing it into the bending moments, we have:

$$\frac{266000}{10.5} = 25\ 333 \text{ pounds}$$

per square inch in one case, and

$$\frac{304000}{10.5} = 28,943$$

in the other, which amounts represent the tug tending to produce rupture at the remote fibres of the pin. These stresses show that while the pin was too small even for the lesser figures, no matter what the material used, its life was shortened under the action of the higher stress, as should be expected.

The causes referred to as influencing failure are existent in all crank pins that we have ever seen made with a collar let into the wheel hub, and if a pin does not get loose or break, it is because the section is large enough to resist the forces at work to that end, and this it is well known is exceptional, for it is a notorious fact that it is only recently that crank pins have shown dimensions commensurate with the increase of boiler pressure, and even these are carrying the badge that indicates an early failure, as we noted very recently in some new wheels not yet under the engine, the pins of which were of magnificent proportions, but the collar was a long ways from a fit.

In all cases of the kind coming under our observation, there is a great deal of wise talk about poor material in pins when they refuse to do work under the above conditions. Honesty, at least, demands that the responsibility for failure should be placed where it belongs, and this in the greatest number of instances would put it against design and not material. The advantages of a collared pin that fits are unquestioned; but it were better to leave the collar off and make a straight fit, rather than to continue the bad practice shown in our engraving.

Paternalism seems to be on the increase in railway management, if the order we hear of as emanating from the general office of a trunk line is true, where the color of an employé's shoes and necktie is specified. It must grate harshly on the tender temperaments of trainmen that are addicted to tan shoes and white neckties, to forswear the same for funereal black; but that's what they must do if they come to time on the latest regulation.

Fads and Fancies—No. 10.

This was one of the mechanical curiosities of he World's Fair and attracted much attention for two reasons. It was a splendid piece of workmanship, and it was as freaky as any engine ever built. It was designed by a Mr. Winby, of London, and built by Hawthorne, Leslie & Co., of Newcastle.

The outside cylinders were 12½ by 24 and coupled to rear drivers, inside cylinders were 17 by 22, and coupled to forward drivers. These were all 90 inches in diameter. Outside cylinder had Joy motion, inside had shifting link.

The boiler was not round, but elliptical, so as to go between drivers.

The engine was designed to pull heavy fast passenger trains, but was never satisfactory.

After the Fair she was put on the Chicago, Milwaukee & St. Paul road to haul ten sleepers 82 miles in two hours.

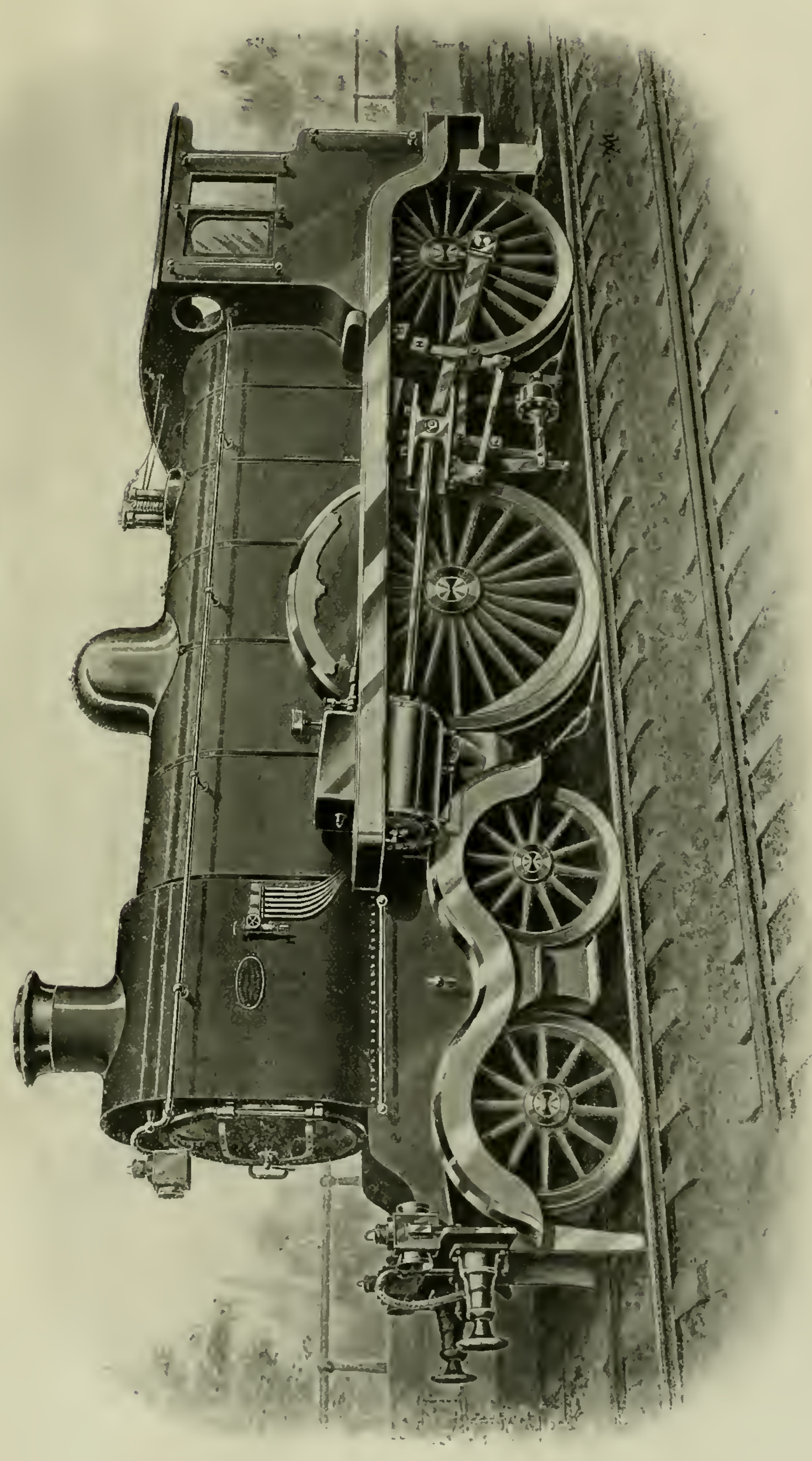
Various alterations had to be made before she could be used on our roads, but with them all she wouldn't steam, the boiler leaked, machinery broke down and in fact she wouldn't do at all. If she hasn't been scrapped she can probably be bought cheap by anyone interested.

The Heel Tool.

The heel tool, the tool that was stuck in a long handle much the same as the present lathe hand tools, but with a handle long enough to pass over the shoulder of the operator while grasped by both hands, and a heel on the bottom of the tool which was supported by a rest as close to the work as possible, was at one time an important factor in shop work, but it has gone to that bourne where the old machines that knew them are piled up in scrap.

The hand tool did not long survive the lathe it was used on, and there is no one to be convulsed with grief at the passing of either. But some good work was turned out by means of these uncouth long handled affairs when an expert got hold of them, and on threading bolts the hand tool man was a power to be reckoned with at one time; yet there are very few of the younger crop of mechanics who would know a heel tool if he saw it, and it is just as well that he did not know anything about it, for the memories left to those who wrestled with it are simply visions of hard knocks and often serious hurts, for be it known that the point would sometimes catch in the job, and the firmest grips on the handle would not prevent a good hard blow on the jaw or side of the head.

The fact that the intensity of the blow was inversely as the lever arms from the heel to ends of the tool, never seemed to have any meaning to the victim, and it is a good thing that the barbarous old relic has at last been discontinued.



FADS AND FANCIES IN LOCOMOTIVE BUILDING—No. 10.
THE "JAMES TOLEMAN," 1892.

Lining Guides.

BY IRA A. MOORE.

Continued from August number.)

We must have some way to know when the guides are the right hight. Fig. 20 is a tool generally known as a guide liner or guide gage, used for finding hight of guides. It is made of ⅝-inch square steel, with a ¼-inch screw through its center, as shown. To set the gage, set the crosshead on its back end and clamp a straight-edge on the bottom of each wing *m* and *n*, Fig. 16; then lay the gage on the crosshead with the faces *a* and *b*, Fig. 20, against the straight-edges as shown in cut. Now run the screw up or down until the point is the same hight as center of piston-rod hole in crosshead, then fasten it with the lock-nut *c*, Fig. 20. Put the gage

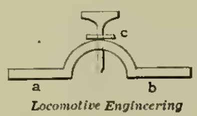


Fig. 20

across the bottom guides, when the point of screw should be same hight as center of line through cylinder to have guides right hight. But it is possible to have the line and point of screw same hight, and yet not have the guides right. Suppose we find on trial that, according to the gage, the guides are the right hight at the front end. Now put a straight-edge across the frames just back of front blocks, then set calipers to the distance between the straight-edge and one of the guides, say the inside one. Try the calipers between the straight-edge and the outside guide. Suppose it is found to be ⅛ inch lower than the other. Since according to the gage the guides were the right hight, we must make the distance between each of them and the straight-edge equal, without changing their average hight. This can be done by raising the low guide half the difference of their distances below the straight-edge, or, in the present case, by raising the outside guide 1-16 inch and letting the other down the same amount. Now put the straight-edge across the frames opposite the back end of guides and set them the right hight in the same way. The front ends should be gone over again, since adjusting the back ends will affect the other end. Now put liners enough between blocks and guides to hold them in this position when the nuts are screwed up tight.

It is best to use one liner thick enough to fill space between block and guide, except about 1-16 inch, which can be filled with liners such as tins and Russian iron. Screwing up the nuts will be liable to spring the guides up or down in the center of their length. A straight-edge placed on their face will show how much and which way they are sprung. Suppose it is found that the outside one is to be sprung up in the center, or at *o*, Fig. 19. To straighten it, unscrew the nut on front bolt and put a strip of tin between guide and block at back end of block. When the nut is screwed up, this strip will strike the block first, and as the nut is tightened it will spring the guide down at *o*. Now try the straight-edge again. Possibly the guide is now low at *o*; if so, the strip is too thick and must be taken out and replaced with a thinner one, say two thicknesses of thick paper. Tighten the nut and try the straight-edge again. Experience will teach the workman more about the use of these strips for straightening the guides than anything that can be written.

When a strip is placed between the bolt and the center of the guide's length, a liner of the same thickness should be taken out, otherwise the guide will be the thickness of the strip too low, supposing it to be a lower guide. But if the strip is on the other side of the bolt, it will not affect the hight of the guide at the end.

Now put the crosshead in place and slide it to one end of guides, when very likely it will be found to have a "rock" in it; that is, it will not set perfectly solid on both guides. Suppose it to be at back end of guides, and when it is down on inside guide it is away from outside guide at back end of crosshead. This indicates either that outside guide is too low, or other one is too high at that end. Hence, enough liner will have to be put under inside block, or taken from under outside, to remedy that defect. This will throw the guides slightly out of line, but not enough to have any harmful effect. Slide the crosshead to the other end, and if a "rock" is found there, remedy it in the same way. Care should be taken to have the guides perfectly parallel with the crosshead crosswise, or the bearing will all be on one side of face of guide, thus increasing its liability to heat.

Sliding the crosshead from end to end a few times after putting a little oil on guides, will show where the bearing is. If it is found to be on one edge of face of guide, it can be remedied either by letting the high side down by putting strips of the proper thickness between blocks and guides on the high side, or removing them from the low side. Before commencing to put on the top guides, it is better to trim the bottom liners, especially at the ends of blocks, because after the top guide is in place they are difficult to get at.

Now put a support under the inside bottom guide and take out the bolts, when the top inside guide can be laid in place and enough liners put between it and blocks to hold it about 1-64 inch away from crosshead. It can be sprung up or down at the center if necessary, in the same way as the bottom ones were. Proceed in the same way with the outside guide, when we will be ready to ream the bolt holes. Having used loose bolts in lining the guides, no doubt they are now slightly out of line sidewise; but lines have been made on cylinder head and guide yoke to indicate their proper position, hence all that is necessary now is to set them to these lines, clamp them in that position, ream the bolt holes and put in the bolts.

To enable the roundhouse machinist to keep the guides in line when closing them, we will give him some points for his guidance. Scribe the line *a b*, Fig. 19 on outside and inside of crosshead, and parallel with faces of guides. Make a center-punch mark *a* and *b* on this line near each end of crosshead, and on the guide blocks the same distance above faces of guides as *a* and *b* are, make the center-punch marks *c* and *d*. Then, when closing the guides, all that is necessary to bring the crosshead back to the proper hight is to bring these four points into a straight line on both inside and outside of crosshead.

Railroad Service in Brazil.

"Some time ago," says a Sao Paulo (Brazil) paper, "a general was sent to one of the northern states to investigate the management of a government railroad. He belonged to the set of men who had made themselves obnoxious by their endeavors in the service of reform, and here are some of his experiences: The very first day he found, in one of the rooms of a railroad station, a strong young man who was doing nothing. Thinking the young fellow had come to see him, he asked: 'Do you wish anything, my friend?' 'No, sir; I am employed here.' 'So! What are your duties?' 'I have to fill the water jugs in the office every day.' The general was a little astonished. In the next room he discovered another able-bodied young man smoking a cigarette. 'Are you an employé?' he asked. 'Yes, sir. I am the assistant of the gentleman in the next room.' But that was nothing to what was to come. The general had already been informed that the road employed eighteen engineers, while only eight were working. He ordered that in future these men should at least take turn about. The next day one of these 'engineers,' a beardless youth, came to him and told him that he could not run a locomotive to save his life. 'Then how did you get on the pay-roll?' 'Well, you see, general, it's this way: My family are poor, but I wanted to study law. We've got some pull, so I managed to get an appointment as honorary engineer, to make a living while I pursue my studies.' "

The latest catalog of the Chicago Pneumatic Tool Company, which we have received, shows their line of wood-boring machines, breast drills, car jacks and painting machines. It is almost a story without words, as reproductions from photographs show the tools at work in various positions.

Practical Letters from Practical Men.

All letters in this Department must have name of author attached.

Turning Curved Surfaces on Boring Mill.

Editors:

The enclosed photograph may be of interest to you as showing how we are turning up curved surfaces on a 37-inch boring mill. All the boilers we build are fitted at different parts with wrought-iron flanges for hand holes, etc., and as they have to be nearly all riveted to the cylindrical parts of the boiler, the surface that fits to the boiler has to be machined to a radius. We formerly did this work on a shaping machine, but it was not satisfactory, and the number of pieces finished each day was small. The arrangement shown on the photograph was therefore devised and applied to a Bullard boring mill, with the result that we are now facing about twice the number of flanges in a given time, and the quality of the work has much improved.

On the table of the machine is bolted a cast-iron ring, flat on its lower face, but curved on its upper to a shape corresponding to the curve the boiler flanges are to be turned to. We use but one head of the machine, and that is provided with a special tool post made like an inverted "T," the vertical part of which is extended upwards far enough to admit of placing a number of circular weights on it, while the horizontal part is fitted at one end with the cutting tool and at the other end with a stout circular spindle having its lower extremity turned out concave to form a bearing for a bronze half sphere whose flat surface rests on the cast-iron ring already mentioned.

The weights keep this half sphere pressing heavily downwards, and as the machine revolves the tool post rises and falls in accordance with the contour of the cast-iron "copy" ring. This arrangement was worked out by Master Mechanic A. Karagopoloff and Assistant Engineer W. Subbotine. Yours truly,

W. F. Dixon,
Chief Eng., Loco. Dept., Sormovo Co.
Nijni Novgorod, Russia.

Hard-Riding Engines.

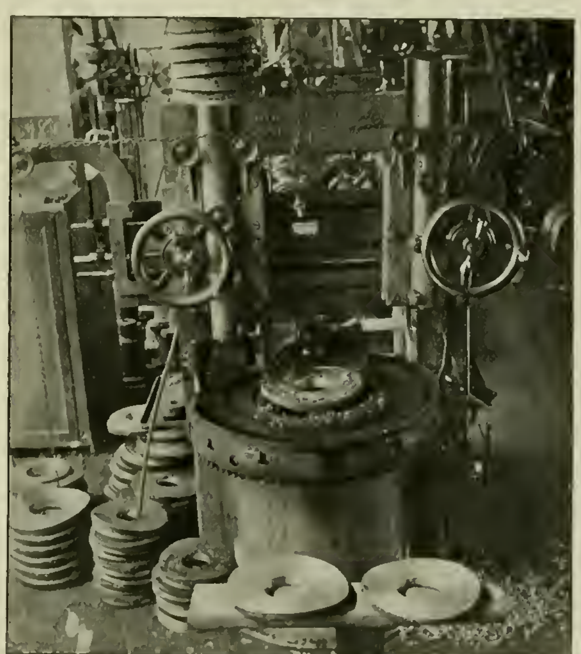
Editors:

In your acknowledgment of my letter, in June number of Locomotive Engineering, re suggested alterations in locomotives, to make easy riding, you hardly put the matter correct. I suggested that a pair of wheels be placed at the trailing end to carry the cab and footboards apart from the engine, except the check plates for axle boxes to work in. The idea is to prevent the shock from the engine being felt in the cab, also from the irregularities of the road, there being no weight on those wheels except the cab.

I agree with you that rough-riding engines are much more conspicuous in New South Wales than in the States. This is owing to the fact that most of our engines are English build, without equalizers, except in few cases. I for one who has had experience on both English and American locomotives, cannot agree with the member of the New England Railroad Club, except that the addition of the spiral spring would make things better. As it is, there is just about the difference in an English engine and an American engine, to ride on, as the bullock dray and the buggy. If his suggestion will improve American engines to such an extent, I wish him all the good things this world can bestow. But if he wants to feel well tired, I would advise him to do my run of 160 miles per day for a week on a Manchester (England) engine, and if after that he has not had enough to convince him—well, I will stay at home while he does it over again. I don't think there is a matter that is of such importance to engine drivers (as we call them; you call them engineers) as the fact of rough riding. The mileage run on our roads being considerably increased of late years, it is telling a serious tale on the running men; they are giving way in the back and legs very fast.

I am sorry you had not managed to print my letter, as I thought it would have opened up the matter with good effects.

D. H. Stewart.
Penrith, N. S. W.



TURNING CURVED SURFACES ON BORING MILL.

Keying Side-Rod Brasses.

Editors:

In the August number, page 384, C. W. K., Charleston, Ill., asks: "What part of the stroke would be the proper place to stand an eight-wheel engine, in order to key the brasses in the back end of main rod, and why? A.—When the pin is new there is no choice of position for keying the brass in back end of main rod; but if worn, the keying should be done with the crank on the center, for the reason that the brasses are then keyed against the largest diameter of the pin."

Now I want to take exception to the latter part of that answer. I would say that both ends of rod should be keyed with pin on the quarter, for the reason that the brasses are then keyed against the largest diameter of the pin. Both pins are worn most when pin is on the center, for the reason that there is more pressure in cylinder at commencement of stroke than at any other part of the stroke. Another reason for pins being worn most when on the center is, that there is more or less pound, due to change of stroke and lost motion between brasses and pin. The wrist pin gets its wear mostly on front and back face; the main pin gets worn most on the side opposite wheel center—that is, the same side of main pin gets the high pressure and pound due to change of stroke. Respectfully,

ORANGE POUND,
Engineer, S. F. & W.

Bartow, Fla.

[This is an instance in which theorizing must be unsatisfactory, and the best solution of the question, to which exception is taken, is therefore a practical one. If our correspondent will carefully caliper worn main pins, he will find, as we have, that the pin will, in nearly all cases, be the largest on the diameter represented by the center line through crank pin and axle. In fact, we have never found a pin worn except as above, and from the forces at work, it is just what should be expected, for the reason that the pin is obliged to withstand the piston's thrust, from admission to the point of cut-off, and between these points is where wear takes place on the pin; after which the thrust is diminished by expansion, leaving the pin with the maximum wear at an angle usually less than 90 degrees with the crank arm; the wear being in the same place for both forward and back strokes. Among a number of pins recently examined, both passenger and freight, three years' wear was almost inappreciable, and in one case of almost eleven years' service, the wear was less than 1-64 inch, and always at point as noted above.—Ed.]

Instructing Firemen.

Editors:

In your September issue you speak of the coming meeting of the Traveling Engineers' Association and a question which comes up before them, to wit, "How can the Traveling Engineer best instruct and assist the fireman in the economical use of coal?" Economy in fuel is one of the most important questions of the day with railway companies, and there never has been the interest taken in this question that there should have been. Firing a locomotive is a nice job when it is done properly. Some firemen can do a nice job, while others can't be taught to do the work well. Why not commence right, by hiring men for firemen who are fitted for the position, or at least as near as a "raw recruit" can be.

We all know some firemen are easy to instruct, while with others it is uphill work from the day they commence till they are called in to be examined for promotion, after trying to be good firemen for seven or eight years and not succeeding.

After a man has started firing, he should be examined every year or so to find out what he has learned, and at the same time he should be instructed by his engineer and by the traveling engineer.

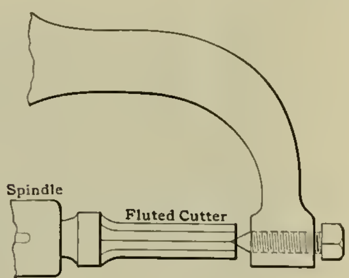
A. L. BEARDSLEY.

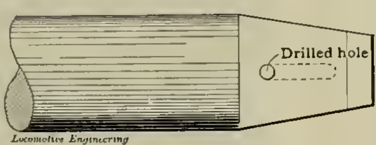
Chanute, Ky.

Milling Key Seats.

Editors:

I have been looking over your August number and see an article on "Chipping Out Key-ways in Piston Rods." I believe in the Oakland shops they cut them out quicker than any other place in the





United States. The work is done on a small milling machine, as follows:

The key-way in piston is laid off and one hole drilled in end of key-way—a small tool something similar to a reamer—flutes are a little deeper and a little more back-rake. The piston is set on table, and tool is stuck in arbor of machine and through hole in piston. Set piston rod on two V-blocks on milling machine table, and set it accurate, so when it is bolted down the cutter will run free in hole. Have hole about 1-32 inch large, and drill at large end. The work is fed along same as any other, and is quickly done. To get taper for key, swing piston rod around a little. After it is set, start up machine and your key-way is finished complete in about eighteen to twenty-five minutes. This tool was invented by Mr. Hall, the general foreman of the Oakland shops. There is no patent on it.

W. D. HOLLAND.

Oakland, Cal.

Spring Equalizers.

Editors:

In my article on "Spring Equalizers for Locomotives," in the July issue, I simply covered the laws governing moving bodies poised on springs. Now it will be quite proper to give the equalizer its "Waterloo," mechanically. Let us see what the equalizer really does in the way of pounding both permanent way and locomotive to pieces, and I can do no better than to repeat my remarks made at the New England Railroad Club:

"In order to properly understand the necessity for a better method of spring suspension, let us take a four-wheeled coupled locomotive, in which the equalizer represents a very important item. The drivers in the forward motion meet all the joints, frogs and switch points first and transmit the shocks through the equalizer to the trailers. The trailers in turn, when they meet the bad joints, frogs and switches, send the shocks forward to the drivers. In this you will observe there is a doubling of the shocks or vibrations."

In carefully studying the spring suspension of some of the newest and heaviest locomotives, it is a cause for profound astonishment that this very, I may say most vital, part of the engine is given "make-shift" attention. One can only believe that the locomotive is all designed and then the draftsman says, "Well, I must get the springs under this machine," and he starts in for a puzzle that would make a Chinaman ready to drop his queue before he could solve it. The combination of levers, springs and hangers is certainly brain-twisting, and would be worthy of congratulation if intended for a flying machine.

When at the shops of a large Eastern railroad the other day, they were preparing to put the wheels under a heavy mogul. We ventured to say to the general foreman, "I will give your best mechanic a ten-dollar bill if he will assemble the levers, springs and hangers of that engine without the aid of a blueprint." "Why," he remarked, "they can hardly do it when the print is before them." And still we wonder these heavy machines are so expensive to repair.

When we turn to the bicycle frame, we have a sense of peace come to us. The steel tubing made by the most expensive method possible is carefully tested, and when set up the frame is protected from vibration, not by the rubber tire, but by a tapering fimbrated sleeve that is placed inside the joint so that it will fit snugly into the inside of the frame tubing. When you ask the expert bicycle maker what that is for, he will say, "to absorb the vibrations"; but you say, "What about the tires?" Well we know by experience where the frame gives out, and we have learned in our testing laboratory that we must provide some way of neutralizing the vibrations, and in our experience we find this sleeve at each joint does the work. Very clever, is it not?

The designer of the locomotive prefers to have his vibrations absorbed by the staybolts, as they are the weakest members under constant varying stresses. Expert mechanics admit that, with the exception of cut driving boxes and leaky flues, there has been no part of the locomotive that has given more frequently repeated trouble and expense than the driving springs. This covers the idea thoroughly.

There seems to be considerable uncertainty among the employés of the locomotive department as to what the leaf spring is capable of doing in the way of absorbing thrusts. As for the spiral, it does not seem to them to be worthy of any more consideration than a block of iron or wood—in fact, if rubber were cheap they would maintain it was far away a better thrust absorber than a spiral. To fully appreciate this only requires a trip abroad among some of them, and when you mention springs you will hear all kinds of heresy.

There are really two kinds only—leaf and spiral. The nature of the full elliptic spring is very nearly identical with that of the spiral. If you load it beyond its sensitive point, it will, when forced by a jolt or jar, close up and rebound or open out considerably more than the normal position when either without load or fully loaded. Broken leaves in this type of spring attest the truth of this statement; for to pull an elliptic spring apart a given distance, will invariably wreck some of the leaves. Another feature of this type of spring is the tendency to keep the load—if the load happens to be a little below the sensitive point of the spring—bouncing up and down, a motion frequently observed in passenger cars where the track is rough, and in buggies on a cobble pavement. To say the elliptic spring is suitable for heavily loaded bodies moving at high speed over an uneven plane, would be to subject myself to criticism, and I will therefore dismiss the elliptic from both locomotive and coaches, as entirely unsuitable for the service. The half-leaf spring presents a basis for the ideal method of supporting all moving bodies that are carried on wheels over an uneven plane. There is no rebound to this type of spring; you may overload it and underload it far beyond the level of the top of the band, and it will, if built of good material, come back to its original set. This allows for a wide variation in the load.

In a locomotive the water in the boiler and the fuel in the firebox are the only elements that cause any variation of the load, therefore a careful and exact calculation can be made so that the half leaf springs under a locomotive should be designed to carry only the load placed on them, but to ask an official in charge to do this would be similar to asking him to put the smoke stack on the cab.

In the electric car we have the widest range of constantly varying load. Here the car leaves the end of the line empty and before going a block 25 persons embark, another block and 25 more, another block and 10 more, and so on until the car is carrying in the seats and on the running board 135 passengers, and at an average of 150 pounds each this would mean over 10 tons, and this load will be dropped in a distance of a mile or two and probably leave only one passenger on the car. With the idea on springs of the average locomotive designer under this car, this poor lone passenger would think he was on the "Rocky Road to Dublin," so stiff and hard would the car ride and some of them do, but as a rule they do not, because the street railways cater to the great army of cranks and the president, who would allow many rough riding cars on his line would have his life made miserable by the letters he would receive.

Therefore, we have the two extremes of loading the locomotive—the ideal, the electric the opposite of this ideal. Now why is it there are so many rough riding locomotives? Because the matter of the springs and spring suspension receives little or no attention; in most cases the springs are made by outside spring makers under contract, so much per pound; the contractor being the designer of the spring invariably makes a spring heavy enough to carry three or four ti nes the load, because he has to renew all broken ones, and as he knows they break he takes no chances, erring always on the side of safety, which in his case means money; therefore, he adds extra leafs entirely regardless of the duties the springs are to accomplish.

J. Hector Graham.

Boston, Mass.

[We regret to say that we cannot endorse the statements made by Mr. Graham in the last paragraph. There are not many master mechanics nowadays who fail to specify particulars of the springs to be used under locomotives and we know that the locomotive builders test the springs very carefully to suit the weight to be carried. They cannot afford to send out rough riding locomotives for that peculiarity gives the engines a bad name among enginemen. Self interest, if no higher motive induces locomotive builders to do their best to produce a smooth riding machine.—Ed.]

Keying-on Piston Rods.

Editors:

It is an easy matter, no doubt, to preach when someone else has set the text; perhaps, however, Mr. Rogers, whose interesting letter (page 378) I duly read, will pardon me for making a few supplementary remarks thereon; such, for instance, as noting the importance of the "side" chisel in key-way cutting, a point he doubtless overlooked.

It is a good many years now since I keyed-up a rod. The last shop where I did that kind of work was down in South America. We had no traversing drills out there. All the key-ways had to be put in by hand, first of all drilling holes as described by Mr. Rogers. If it was a new valve stem or piston rod that was required, or one that had been new-ended, the crosshead was first driven on with a lead hammer to see if the turner had got the taper all right (no grinding on down there then), and if it was, the key-way was then scribed on both sides of the rod while in the crosshead. When the crosshead was knocked off, we shifted the position of the scribed key-way forward (toward the piston) two amounts—the amount of the draft, 1-16 inch, and also the amount to be drawn up by the key, say ⅛ inch. (One-sixteenth inch draft is

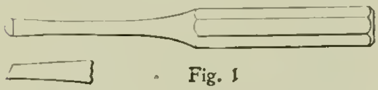


Fig. 1

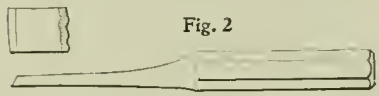


Fig. 2

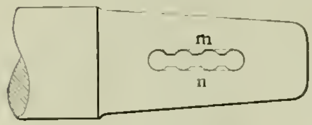


Fig. 3

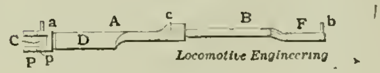


Fig. 4

ample when, as ought to be the case, the rod bottoms in the hole.). Having done this, the holes were marked off, drilled and then cut out with a round-nose chisel, as described in your correspondent's letter. There is, however, one point that should be observed about this chisel, namely, to give it a certain amount of clearance. Thus, as shown in Fig. 1, the chisel should clear itself for an inch or two from the end; just how far, depends on the depth of the holes you are going to use it for. I've often seen men struggling to get their chisel out of a key-way, knocking it backwards and forwards and pulling away at it for dear life. Of course, a little effort will always be needed to get it out, because the extreme end is always tight in the hole; but it makes a great difference whether or not you have the sides of the hole binding hard on the chisel the whole depth.

The tool I used to rely on to get in its work, was what we called a side chisel, Fig. 2. The round-nose chisel shown on page 378 is all right to act as pioneer and cut out a path for the other to work in (see Fig. 3). Now, with an ordinary flat chisel, it is impossible to cut out the hole as left by the round nose. If you tilt the chisel across the hole sufficiently to get the edge to cut at side *m*, you'll bear hard on the opposite side *n*, which won't improve its appearance. In fact, you must have a side chisel, for with the ordinary proportions of depth to width in a key-way, an ordinary flat chisel would only cut the side for a fraction of the depth. By a skillful use of chisel Fig. 2, you can leave yourself a minimum of filing to do.

In cutting out piston rod key-ways, one is not of course particular to a nicety how the crosshead sets relatively to the piston. What I mean is, that, granting the hole is marked off as you want it, you needn't check your work as you go along; if you work to the original scribed lines you'll be near enough. But with valve stems it was different. Fig. 4 shows the arrangement used on the engines in question. *B* is the valve spindle, as it was called, keyed into the guide *A*. (The part *D* of the guide works inside the motion plate, a casting acting as a stretcher, riveted or bolted in between the two frames.) The link block is pinned into the jaw *C*. Now, the face *F* of the valve yoke requires, of course, to be "fair" with the jaw *C*, so as to ensure this face and, therefore, that of the valve itself being perfectly vertical when in position. (Fig. 4 is a view from above, the valves working upright in the steam chest.) It was simply a matter of personal pride to key the guide *B* on so that it did not want any coaxing or faking to get it true with *A* when keyed up. I have in mind the following:

After the job was done it was sent into the erecting shop. Now, there is always a certain amount of play in the valve yoke, even when newly fitted, that will allow the valve to adapt itself to the port faces even if the yoke does not stand quite vertical. But there was nothing to prevent the erectors coupling it up on the bench, as in Fig. 4, and trying it over with the winding strips. Of course, for the job to be right, *A* and *B* ought to stand dead fair with each other (that is, the face *F* and the jaw *C*); if not, a kick might be raised, and sometimes, as you well know, foremen and others can't see when a thing is not wrong enough to do any harm. And besides, in keying the stem up as above mentioned, the erector would simply drive *B* on to *A* about square, and then rely on the key bringing things just right. Knowing this, we acted accordingly. In the preliminary stages we used a spare key, a full 1-32 inch thinner and 1/8 inch narrower than the proper one, thus leaving ourselves something to work on in *B*; for if once you got the hole in *B* large enough for the standard key, and then found it was a bit out of square, matters could not very well be remedied. Of course you could file out either *A* or *B* to allow them to come round as required, but that wouldn't pass muster with the erectors. They couldn't be expected to monkey around, looking for the right position before keying up. You could do one other thing—file both *A* and *B* out and put in a thicker key, but then it would not interchange with others of the same class. This method is therefore out of the question. The idea of making *B* hot and setting it round may perhaps occur to some of the younger readers, but they can dismiss that at once. This is, in fact, one of those cases where you mustn't get wrong. It is an interesting little job to key-up these two parts, so that the cotter shall be a neat fit in both of them, and at the same time the two shall always draw up true with each other.

By the bye, I may perhaps mention one little item that saves one's back on a job of this kind. The winding strips are used pretty frequently, and to avoid the consequent stooping down to take sights, I used a spirit-level on top of the strips. You needn't trouble about the stem being set dead level in the vise, of course; you simply notice where the bubble stands on each strip every time. This practice saves trouble and is much more accurate than sighting with the strips themselves. A "bra' Glasgie mon frae Neilson's" it was who put me up to the wrinkle. When the set in the valve spindle is such that it is desirable to put strip *a* in the jaw *C*, observe to keep it up in the neck, away from the wear of the link block. Always stick to one of the original surfaces, for whenever the pin-hole *P* is rebored or lapped out, the outer surface of the jaw is the one that will be worked to. The strip *b* is laid on the end of the yoke, because any local inequality (a small hollow or the reverse) on one of the narrow sides *F* would throw the thing out considerably, whereas the continuous bar of metal forming the end of the yoke is a reliable guide—first running your file over it, of course. As remarked, I always used an old key narrower and thinner than the standard, for both piston and valve rods. All corresponding keys and pins for engines of same class and build were of the same size and taper, which uniformity was supposed to be maintained during repairs. By the bye, did you ever try chalking one of your strips when taking a thing out of winding; if you chalk the top edge of the far strip, you'll find it a great improvement.

When keying a new guide *A* on to an old spindle *B*—a job seldom occurring; generally for a flaw in the jaw *C*—a little care is required to mark it off correctly, as will be evident on consideration. When *B* is new, you can mark it off directly from *A*, but you can't mark *A* off in the same manner from *B*. You've got to go to the laying-off table with your scribing-block. In such a case it is as well to drill the holes a good 1-32 inch small, so as to have something to work on. It was, I may remark, a point with us to have a clean hole when finished—no drill or chisel marks. True, the engine would run just the same, but it looks bad and lessens one's reputation for workmanship among his fellows.

I would always put a taper hole *C* in the socket of *A* in any job of the kind that I was designing (Fig 4). This makes it an easy matter to start the spindle when required, without having to knock the end of the socket all to smithereens. Of course, when stripped in the shop or roundhouse, there are plenty of pins to hand; but if the engineer ever wants to uncouple on the road, he's sure not to be able to lay his hand on one—albeit the day before he may have been rolling in them. The pin should be made the same as that at *p*, using the same reamer. The engineer then merely knocks *p* out and inserts it at *C*, thus unshipping his stem without any difficulty. I think the neatness of this arrangement will compare favorably with that sometimes seen over here, in which the socket of the valve rod is made nearly twice the normal length, so as to admit another key-way behind the end of valve stem, at *C*. The engineer knocks out the working key and inserts it at *C*, starting the valve stem as before mentioned.

The foregoing remarks may possibly interest some, as showing how things are done in "foreign parts;" they may also give a pointer or two to the "young 'uns."

H. Rolfe.

Scranton, Pa.

Cylinder Clothing.

Editors:

Your editorial on the clothing of cylinders to prevent radiation is timely—in fact, will always be timely, until something more effective in this line is done than is the case to-day.

Steam jackets are out of the question as a practical solution, owing to complications of piping for both supply and drainage, and the fact that few engines make more steam than they can use to advantage in the cylinders.

Hot air or gases from the smoke-box is an alluring solution, but has always been disappointing. Looks as though it ought to work, but never has—satisfactorily. Mr. F. F. Hemenway's experience with that scheme, the ideas of Mr. George Richardson (of balance-valve fame), make interesting and profitable reading.

This leaves one way open to secure better results, and that is to pay more attention to the clothing of the cylinder with a good non-conducting material, such as asbestos, hair felt, or even thoroughly treated wood. Too many builders, even of stationary engines, pay little or no attention to this, and I have seen a compound pumping engine, with steam jackets, yet with practically no clothing outside the jacket, leaving a larger area for condensation than presented by the cylinder itself.

One instance of the successful use of wood comes to mind in the case of a compound (stationary) carrying 120 pounds of steam. The lagging was got out of 2-inch thick pieces, which were carefully dried and then thoroughly soaked in linseed oil. It was well fitted around the cylinder, and after binding in place was thoroughly painted. A sheet-steel cover finished it, and with 120 pounds of steam the outside was cool enough to lay your face against without leaving a piece of skin as a memento.

Steam at 120 pounds is 350 degrees, at 200 pounds, 388 degrees (approximately). If this lagging will answer for the former, a little better one, preferably of asbestos blocks, formed as the different makers form it now, would keep the cylinders of any locomotive cool—and not by dissipating the heat, but by keeping it in where it belongs.

It seems as though this was one point where a little saving is possible, and the little savings count.

Camden, N. J. R. E. Marks.

Southern Pacific Instruction Room.

Editors:

Herewith I hand you a photograph of the interior of an instruction room just completed by the Southern Pacific Company at Los Angeles.

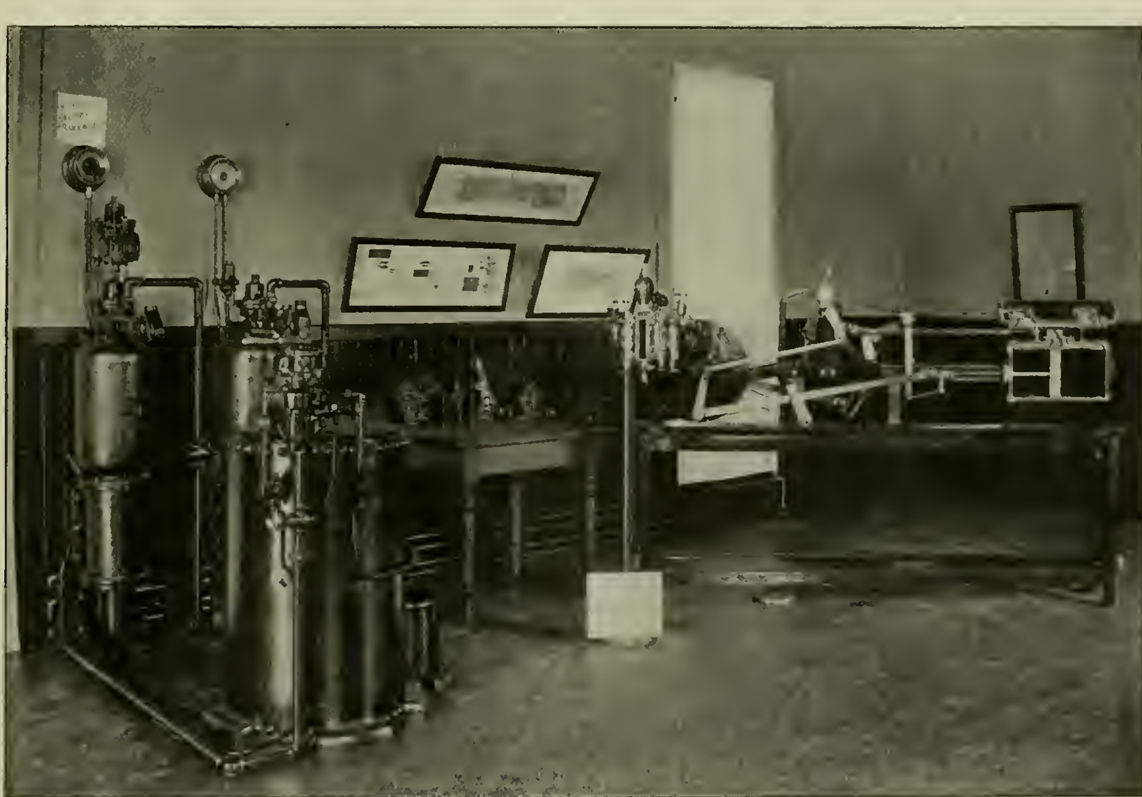
The room is 19 by 29 feet, well lighted and well supplied with settees and chairs for the comfort of the men. On the side of the room opposite that shown in the photograph, in neat frames, are the several plates issued by the Westinghouse Air-Brake Company with their book of instructions. In addition to these is a diagram showing the operation of the A. J. Pitkin's intercepting valve and gear for a Schenectady compound locomotive.

At present our air-brake plant represents two cars, although it is the intention to add four more in a short time. One of the gages shows the pressure in the main reservoir and train line, while the other gage shows the pressure in auxiliary reservoir and brake cylinder. A close inspection will show the arrangement by which the action of the quick-action triple valve is shown—the sectional model attached by ¼-inch steel rod to working triple.

About the time we began to fit up the instruction room, I wrote to several of the railway supply houses telling them what we were doing, and asking if they had anything to contribute, either as an exhibit or for instruction. Only two of them responded—the Crosby Steam Gage Company donating the duplex brass gage shown on the left, the dial of which has been cut so as to show the interior working of the gage, and the Nathan Manufacturing Company donated the sectional model of their sight-feed lubricator, equipped with patent circulating valve attachments; and in response to a similar request, the Locomotive Engineering donated several educational charts, of which No. 5 is a great aid to a comprehensive understanding of the automatic brake, and last but not least, in an educational sense, is the valve-gear model. There are two separate valve gears; one is the ordinary slide valve, and the other the Stevens gear, and with the aid of this model the Southern Pacific has more engineers who can, if necessary, set their own valves than any other railroad in the United States.

W. H. Russell.

Los Angeles, Cal.



SOUTHERN PACIFIC INSTRUCTION ROOM.

Toronto railway shops seem to have imbibed the compressed air ideas very fully, as the results seems to be present everywhere. At the Canadian Pacific Shops, Toronto Junction, whitewash is freely used and light shops are the result. Air hoists and tools are also used and seem to be growing in favor. It's a good sign.

The Builders' Iron Foundry, of Providence, R. I., have issued a neat little standard-size catalog of their grinding and polishing machinery. It shows quite an extensive line of goods which are used in both shop and foundry, and bright shop men ought to be familiar with it.

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Forced Draft for Boilers.

The use of forced draft for increasing the steam-making capacity of boilers is extending very steadily in Europe, and those who have had experience of this method of stimulating the fire in furnaces, speak very highly about its advantages. Various systems of forced draft are in use on many first-class steamships, and boiler-users of all kinds are beginning to investigate the merits of the different systems. They may loosely be divided into two methods—one puts extra air pressure upon the whole boiler room or stock hold; the other puts extra pressure upon the ash pit or ash pan. The pressure above the atmosphere varies from ½-inch to 2-inch column of water. The highest of these seems very light, but it creates a remarkably fierce draft. When the system is applied to closed ash pits or pans, the local heat is so intense that water has to be used to prevent the grates from melting.

It is not quite comprehensible why forced draft applied under the grates should be radically better than draft induced by a chimney of proper proportions; but the steam-using world seems to be coming to the conclusion that it is, when applied to plants for which it is suitable. The advantages of forced draft may be due to superior means of adjustment. There is so much diversity and conflict of opinion about the proper proportions of chimneys, that many boiler plants must suffer from too great or too contracted chimney capacity.

It seems certain that, with forced draft, coal can be burned of a much inferior character to that which would make the same volume of steam under induced draft. This was shown about twenty years ago in the power plant used by the Philadelphia & Reading Railroad, at Reading. By using forced draft, they were able to burn the poorest kind of anthracite refuse, but they could not make any steam with it when chimney draft was depended on.

When any improvement, new method or new attachment has been successfully applied to a boiler plant, we soon hear the question asked, Why do they not apply that improvement to locomotives? We have within the last few months had this question asked repeatedly concerning forced draft. Several of these systems are patented, and consequently have a stimulating force behind them which neglects no field where success is probable. From what we have seen and heard about the working of forced draft on marine and stationary boilers, we hardly think that the locomotive offers a good object for the application of forced draft. It may not be known to those who are recommending forced draft for locomotives, that the system was repeatedly used on early locomotives, and that it was only abandoned when even its warmest friends were compelled to admit that the draft created by the exhaust steam passing up the smoke-stack was more efficient for steam-making than any form of forced draft devised by the ingenious engineers who took the lead in making the locomotive a practicable and efficient means of motive power.

When the Liverpool & Manchester Railway Company, in 1829, offered a prize for the best locomotive, Ericsson, the famous engineer, entered an engine for competition, in which steam-making was stimulated by means of a fan that drove air under the fire. An accident to the fan when the speed trial was being made, ruined Ericsson's chance, and let the "Rocket" take the prize and become famous. In spite of Ericsson's misfortune, various pioneer locomotive builders in Europe employed forced draft for a time, and the mechanical department of the Baltimore & Ohio made fan-created draft fairly successful. There are men still living who remember seeing the old Grasshopper locomotives of the Baltimore & Ohio using forced draft, and the pictures of these pioneer locomotives show the fan used for creating draft. The only real advantage of forced draft for locomotives was that a size of exhaust pipe opening could be used that practically eliminated the drawbacks of back pressure in the cylinders. With a well-designed and properly operated locomotive, back cylinder pressure causes very small loss of efficiency, and passing the exhaust steam through a restricted opening is a very simple means of creating smoke-stack draft. Induced draft as used in a locomotive is radically different from the induced draft created by the smoke-stack of a land boiler plant or that of marine boilers. The land or sea boiler chimney is an unyielding article which cannot be changed to suit different demands in the volume of steam to be generated. The locomotive draft appliances, on the other hand, change automatically to suit the demand put upon the boiler by the cylinders. The greater the volume of steam passed through the cylinders, the greater will be the draft employed to generate the necessary supply. On this account the patentee with a model of a new forced-draft apparatus in his grip will find a cool reception when he recommends it for use on locomotives.

How Shop Economies Have Been Effected.

To the average shop manager, the problem of how best to increase the output without additional help, is sometimes a difficult one to solve, made so in nearly all instances by the antiquated facilities with which to keep up the work. This is true of the average railroad shop, which if brought to the consideration of methods evolved by manufacturing plants that could not live under like conditions, but would be forced to schemes looking to the lowest possible cost of production in order to stem the tide of competition, then would a pencil of light show through what had appeared to be an opaque situation.

A shop is simply a shop to an ordinary stockholder, and all equipments look alike to him as a means of landing a dividend. If, then, the appropriation for lubricating the wheels of the plant grows smaller and beautifully less month by month, from the various causes known to the railroad man, the latter is in precisely the same fix as his brother manager of the private shop when he felt the keen fangs of the competitor knawing at his business. Under the circumstances, any request for better facilities are worse than futile, and the only recourse is to make the most of those at hand by improving on their best records. That this can be done will depend on the degree of talent brought to bear in the case.

First, attention must be given to the way tools are manned, and, second, to the way they are handled. If a man is of the genus hustler, and has a disposition to get results, drawn to the same scale as his ability, the combination is complete for making a correct start, because such a man will not use diamond-pointed tools or feeds of a microscopical character; neither will he use a backing belt when cutting a thread, for he knows how to bring the carriage back and drop the nut in on the feed screw so as to "catch the thread" being cut, no matter what pitch he happens to be interested in at the time. These are all minor points in saving time and therefore worth some thought.

As a rule, too little consideration is given to the removal of stock in a railroad shop. To get a banner performance out of a tool, it is necessary to rough out the job as quickly as possible. Depth of cut is as important as wide feed, and a combination of these two factors will soon reach the limit of the machine's capacity; but in the case of close forging to size, as is found in work turned out by the smith that is master of his art, or again, on forgings bought by the pound, in which case the stock to be removed is only sufficient to clean to size, then the cut factor is eliminated, and the matter of feed only requires attention.

With tools of the proper shape, the feed question solves itself, and does it most surprisingly when pushed to the pulling limit of the belt by the man that is not afflicted with any feeling of tenderness for the machine. The same care given to finish cuts also helps out in the saving scheme, for when a wide-nose tool is used on a job, it leaves a true and workmanlike finish as no other method can, simply because it gets over the surface before the cutting edge has had time to dull itself. These ideas are worked out in contract shops, where the value of time is fully recognized, but they too seldom find expression in a railroad shop.

In the matter of shop small tools, under which head come taps, dies, reamers, etc., they are often made in the belief that they are cheaper than when purchased from the manufacturer of these goods. There is no mistake that they are cheaper —in quality, and that they cost more in the end, no matter how the expense account is manipulated. The collection of broken and maimed tools of this kind bears witness that an error was made, and the same holds true of twist drills. There are few shops that can afford to build these tools, because a better tool for the money can be purchased from the specialist, and a loss here must be balanced by a saving in some other direction in order to make that thin appropriation for expenses cover the ground intended. Among other means to assist in the accomplishment of the same thing may be mentioned the massing of all machine tools of a kind—get them together. Put in rope drives to get power around corners, if electricity is not available, and first of all, although last here, it is absolutely necessary to have efficient supervision, as that is the only way to prove that time is money, and that too much of it goes to waste in the average shop. Shop economies have been worked out by attention to the few details noted, and to an extent that would surprise most people who think they have touched bottom with a poor equipment.

The Engineer in Car Design.

We note from the numerous devices brought out for the improvement of railway equipment, that cars are receiving a full meed of attention from those of an inventive turn. This betokens a healthy condition of things, and gives us the right to hope for tangible results in the future development on correct lines, of many car details that too evidently need a change of form or material to properly and economically perform their part in the present scheme of transportation.

Cars are passing through exactly the same critical experience in their evolution, that the locomotive has seen, a lot which is essential to the attainment of the desirable end of making car design the work of the engineer. This period has only just been passed by the locomotive and we know with what results, and the car question when treated on the same rational basis will yield returns fully as valuable in their way. This is more especially true of steel construction where the designer with the instincts of an engineer may dally with the principle of moments to some purpose, and produce a vehicle that will satisfy every requirement of the test of an engineer's skill.

It is only about five years since independent action of any importance has been shown in the design of cars. Up to that time, the same dismal attempts at copying some men's failures, was about the extent of exploits of the kind, and it is about the same length of time that any attention whatever was bestowed on the subject of reducing dead weight to the lowest possible limit, the bearing of which on the score of economy in train operation was not as plain at that time as it has been made since, by that convincing demonstration, the car itself as an object lesson.

The weight of minor details is as potent a factor in this reduction, as is that of the superstructure itself, and the judgment must be a trained one to specify where the pruning can best be done in order to reduce these parts to their lowest terms and yet retain the requisite strength. This judgment must be a combination of the practical with the theoretical to be of most value, as for an example, we may take the case of a heavy cast-iron post pocket, center plate, or side-bearing. All of these may be decreased in weight without the use of a pencil, by a wise choice of material, because the parts are in compression. On the other hand, if an attempt is made to cut down the size of post and framing rods, carlin bolts or truss rods without first calculating the stresses they are called upon to resist, disaster is likely to result.

In the latter case as in the design of the car body is where the engineer is found worthy of his hire, for the reason that lesser material will be paid for and less weight will be hauled per unit of load. The effect of this system is more and more apparent in the newer cars and shows clearly the percentage of engineering ability brought to bear in their design.

Master Mechanics' Wire Gage.

People who have anything to do with the ordering of sheet metal, wire, tubes and other articles less than a quarter of an inch in thickness, have experienced no end of trouble by the orders being given for the thickness to be in terms of the number of a certain gage. As there are five or six recognized gages, and as the numbered dimensions do not agree, the result is that mistakes are very common, and delay, annoyance and expense result. Some years ago the Railway Master Mechanics' Association appointed a committee to investigate the matter of wire gages, and to propose a remedy, if practicable. That committee entered very heartily into the work and succeeded in obtaining the co-operation of the American Society of Mechanical Engineers. The Master Mechanics' Association committee, after much careful labor, made a report recommending a gage having positive divisions of the inch expressed in decimals. The gage has slots which are used for measuring the material. The Master Mechanics' wire gage was endorsed by the American Society of Mechanical Engineers and by the principal Association of Sheet Metal Makers. After establishing the gage as a standard, the Railway Master Mechanics' Association arranged with the Pratt & Whitney Company, Hartford, Conn., to manufacture the gage, a precaution deemed necessary to guard against the inaccuracies of ordinary tool-room manufacture.

We apologize to our readers for repeating that page of ancient history, but we rewrite it because many of the people who helped to establish that standard gage appear to have forgotten about its existence. They continue to order tubes, sheet iron, etc., to conform to some number of Birmingham, Stubbs or other ancient gage, just as calmly as if nothing had been done to remedy the confusion that these old gages caused.

One of the most fertile subjects of discussion at meetings of railroad officials is, "Methods of Educating the Lower Grades of Railroad Men." We believe that business would not suffer if a little attention was directed to educating the higher officials in methods calculated to save the company's money. Standards are established so that uniform practice will reduce the cost of production and facilitate repairs. Master Mechanics and Master Car Builders talk beautifully and eloquently in meetings about the advantages of standards, and think no more about them until next time there is an opportunity to make their voices heard. Their position is always like that of a cross-road finger-post, which points the way it has no intention of following.

Let us conclude by suggesting that our mechanical men turn to the end of the annual reports of their associations occasionally and read over the standards. They will find a standard wire gage among them.

Locomotive Design.

Our cousins on the other side are still looking for some of the reasons why their trains are late, and incidentally comparing their engine performance with our own in heavy haulage as well as fast work. In casting about for a possible solution of the fact that the American engine is superior to others in point of economy for equal work done, the matter of heating surface is very generally discussed, and the bearing it has on the exercise of energy over long fast runs.

The advantages of large wheels for such service are also gravely handled, as was the case a few years ago in this country, when the speed schedule was sharpened up and the train weight increased, at which time our present giants of the rail were in the dream stage, and when the small wheel was the only way to realize the tractive force necessary to haul the assigned loads, with the light power in use at that period.

The suggestions of some of these writers, who, commenting on the confusion incident to individual design, and therefore advocates of centralization, are certainly humorous when viewed from the vantage point of the devoted ones that are doing all in their power to stem the tide of unsought advice from the uninitiated, which only intensifies the very thing they seek to avoid. Among some of these we note that it would result in an improved condition of motive power, if the character of service to be performed, together with a limit of weight and fuel and water consumption, were specified—all other particulars being left to the builders.

If there is any one thing that could possibly result in failure to produce economical results, it is the placing of locomotive design on a commercial basis. It might prove a boon to the builder, but it would be a bane to the purchaser, simply because there would be an end to the standardizing of parts, and maintenance cost would increase as a result, not because of the incapacity of the builder to produce a machine to give the highest economy, but for the reason that the head of the motive-power department has not been allowed to name details that are absolutely essential to the proper upkeep of the power, under conditions peculiar to his line. This is one of the most serious handicaps the head of this department is forced to face, and, fortunately for him and his road, it is passing here; and it is also coming to be understood that other engineering departments can be of more use to a railroad company in their own legitimate field than in locomotive design.

The fact that the American superintendent of motive power has designed the magnificent machine that gives the three prime requisites in locomotive design, namely: power, speed and economy in performance and maintenance, furnishes all the proof needed that he is able to cope more intelligently with the problems of his department than can officials of other departments who are usually equipped with nothing but an overweening desire to run everybody's business except their own. There is good ground for the opinion that it is interference of this character that often prevents satisfactory results in motive-power affairs, rather than want of ability in the presiding officer.

Motor Carriages.

A few years ago the engineering world seemed to have suddenly discovered that the building of railroads and other elaborated methods of transportation had led to the neglect of what could be done on common roads. The bicycle had demonstrated possibilities of fair speed on common roads, and that suggested the use of power-driven light vehicles that might outrun the bicycle and carry several persons, without the expenditure of any labor on the part of the riders. The idea was quite alluring, and an epidemic of motor carriage inventing passed over several countries. France was worst infected, and took very kindly to the malady. We remember reading the prediction that France was going to enjoy the glory of giving to the world motor carriages that would be as popular as bicycles and as useful as railway trains.

During a recent ramble in Europe, we have been looking for the motor carriage that was to perform such wonders; but its growth seems very feeble, considering the noise that arose on its birth. Motor-cab companies have been formed in several European cities, and makers of motor carriages are numerous, but their product seems to be met as rarely as the chainless bicycle. In the course of a day spent lounging about the streets of Paris, looking for sights, we saw five motor carriages and two delivery vans driven by motors. We saw one in St. Petersburg, three in Vienna, quite a number in London and a few in other large British cities. They have not yet, however, become common enough in any city that the people do not turn and look at them as they pass, in the same way that they stop to look at an elephant going through the street.

When the first attempts were made to design a practical carriage motor, the power most commonly selected was steam, and some highly ingenious work was done in making light boilers with the maximum of steam-making capacity. Gas, petroleum and electricity were the rivals of the steam-engine motor. From all we could learn, the gasoline motor and a motor driven by electricity carried in storage batteries are now the most popular. Both kinds have their strong and weak points, but the indications are that they will continue as rivals for years to come. The objection raised to the petroleum compound as a power producer is its smell. Its friends say that there is no more smell from a petroleum engine than there is from a pair of horses, and they have numerous objections to urge against the electric motor. The storage batteries are said to be too heavy, and a rider on an electrically-driven motor carriage cannot go far from an electric plant without danger of being left in the country with a dead machine.

Inventors are still working on the perfecting of these motors, and every year will doubtless see new improvements introduced and leading defects overcome. At present the most formidable obstacle to the rapid introduction of the motor carriage is the high price demanded for it. What may be considered a first-class motor carriage similar to the Winton shown at the railway mechanical conventions at Saratoga in June last, costs about $2,000. Only half that price is asked for the Winton motor carriage; but even that sum can be spared by only a small proportion of people. Scarcity of the wherewithal to buy the vehicle is, however, the chief cause for so few of them being in use.

Relation of Bolsters to Side Bearings.

The very intimate working relations between side bearings and body and truck bolsters, make a consideration of either one of these practically an invitation to go over the status of both, and this is becoming more evident as the fact is forced to the front that something must be done either to produce a bolster strong enough to sustain its load alone, or make a compromise and let a part of it be carried on frictionless side bearings. There is nothing specially new about this situation, it being simply up for discussion again among the car stock subjects, but is assuming greater importance with the increase in size of freight equipment.

Those having light bolsters to maintain are in general the best advocates of distributing the load on side bearings having a low resistance; such bearings are said to be in use, but there is no authoritative data on which to base an estimate of their efficiency. Without a knowledge of the resistance caused by such bearings, the case is simply one of conjecture as to the amount of energy going to waste in order to hold a train equipped with them up to speed on curves. This uncertainty does not exist where the load is on the center plates, for the truck is normal to its path, and flange friction is then at its minimum, a condition necessary to economical use of the locomotive's tractive effort.

There is an opinion held by some, that there are insuperable difficulties in the way of getting the proper stiffness in bolsters to keep the load on the center plates, because of a limit set for the hight of draw-bars; but it is an erroneous one, for bolsters need not necessarily be made on old lines in which both members are under the sills. Such construction of wrought iron could be made barely rigid enough for a 40,000 capacity car with the depth available, as everybody knows who has given the matter any thought. There are no difficulties in the way of placing the top or tension member above the sills, and thus have a depth commensurate with the increased demand for stiffness, besides having a bolster that is reasonably light for its capacity.

In the latter connection, attention is called to the advantages of locating the truss rods at their intersection with the bolster, at a point as near the center as possible, and thus reduce the lever arm of the load deposited by them on the bolster, as explained more at length in our issue of November, 1897. Bolster possibilities are by no means at an end, as the good ones in steel already made will attest, and those who have them do not favor the distribution of load over center plates and side bearings; while, on the contrary, those not so fortunately situated look on such distribution on rollers as the easiest way to overcome what has developed into an evil of considerable magnitude.

A Roller Bearing Journal Box.

Some of the new patented devices intended for use on cars evince the same old shadowy perception of what is needed, as the most vague productions heretofore brought out. Prominent among these is an attempt at a roller bearing journal box.

There is no one to say nay to any improvement of the car journal box, for it is a field fertile enough for further investigation, but strange it is that there is very little effort expended in a direction that would give substantial returns for improvement of it, therefore, the prospect of ever realizing on the mental labor involved in the improvement of the box on the lines noted, is of the most attenuated character. In this instance, a box of the usual form is simply a receptacle for holding a series of rollers whose length equals that of the journal, and affords a good example of the crudest possible application of rollers to a car journal.

It is simply a case of juggling with facts, to call anything an invention that is only an imitation of what has long since been cast aside as impracticable for use in the form cited, in which there is no provision made to hold the axis of the rollers in alignment with that of the journal, without which restraint the device is worthless. The roller bearing is successfully used in reducing frictional resistance in heavy machinery, and there is no good reason apparent why the same thing cannot be done for the car journal.

A Misapplied Term.

The word "progress," literally taken in its general acceptation, means to advance, and being fully alive to that understanding, we have been agitating all the convolutions in both lobes of our thinking mechanism, in the attempt to find the excuse for the application of the word to a main rod we inspected, not long since, on a new ten-wheeler which was coupled on its train and ready to pull out. This rod had a strong family resemblance to main rods on that type of engine, except in one particular, namely, the shape. This rod was parallel—same depth at front end as at the back, and was therefore a strongly marked remove from the shapely rods of a tapered section such as we had been accustomed to. "That's a fine-looking machine," we ventured to intimate to the engineer, as he ran a piece of waste along the snout of his oil can. "Yes," was the courteous reply; "and she is as fine as she looks, and probably represents the best progress in locomotive design." With a yearning after some light on that main rod, we mentioned the fact that it appeared like a strong job. "It is a rod that won't give out on the road; you can see it's as strong at one end as at the other." This was too plainly in evidence to file an exception on, and as our thoughts reverted to all the schemes that had been worked out to reduce the weight of reciprocating parts, we could not help but think that there was a superabundance of material in the front end of that rod, and just how we are to fit the word "progress" to it is not quite clear.

Where Technical Graduates Have Missed a Good Thing.

Within the last few years electric lighting plants and refrigerating plants have been introduced into all transatlantic steamships. This has brought into use a great deal of machinery that the ordinary engineer does not understand very well. It would naturally be supposed that caring for that kind of machinery would provide positions for graduates of technical schools, and we have been very much surprised to find that few, if any, technical school graduates have positions of this kind. They are nearly all filled with handy men from the engine-room force who have had ambition, intelligence and perseverance enough to learn the technical knowledge required to manage the kind of plants mentioned.

Speaking to a chief engineer of a leading transatlantic line on the subject, we were informed that the technical graduate had been tried, but was found wanting. He would attend to the plant well enough when everything was going all right, but if anything went wrong he was helpless and would not creep into hot or greasy places to look for the cause of defects. And so the practice of looking for technical graduates to perform duties which they were naturally well adapted to was gradually abandoned.

Making a Perfect Cube.

There is always a period in the career of the machinist, when he arrives at that exalted idea of his skill, that no job is too difficult for him to tackle. This is the time when his mouthings about dexterity in the handling of tools, close work and all that sort of thing, attracts the attention of the old-timer, and the latter does not want anything better than a chance to pull the callow party off his perch. This he easily does by proposing that the smart one plane or file up a perfect cube. "Pride goeth before a fall" in every instance of this kind. It used to be a stock catch, and probably is yet; but it is a sure cure for conceit, and never fails to bring the lesson home, that the handicraftsmen are scarce that can produce a perfect cube. The apparent simplicity of the undertaking is what embitters the failure, and any attempt to explain how it happened only aggravates a bad case. We know, because we tried it a long time ago, when we thought the toughest job would be as clay in our hands, and—well, it was never explained.

Change of Address.

When a subscriber changes his address he should immediately notify this office, so that his paper may be sent correctly. We are continually being notified by the postmasters that subscribers have "moved and left no address," and it makes unnecessary work for us both. We want each subscriber to get every issue of the paper promptly, and if we are notified of change of address, it will help make things more satisfactory for all concerned. Club-raisers can assist by posting us on changes in the addresses of their subscribers.

Both the *Street Railway Journal* and *Street Railway Review* spread themselves on their convention number last month. They were large, so many pages we couldn't count, and weighed a ton—or less. Both were freely illustrated and contained interesting articles on technical and general subjects. From an artistic point of view the latter excelled a trifle, but both were good examples of modern technical journals. When we consider the advance that has been made in engravings and press work, we are apt to wonder what will come next.

PERSONAL.

Mr. F. W. Gilcreast has been appointed division engineer of the Lehigh Valley, with office at Hazleton, Pa.

Mr. I. O. Nicolas has been appointed master mechanic of the Toluca & Tenango of Mexico, vice Mr. E. W. Knapp, resigned.

Mr. O. M. Laing, cashier of the Seattle & International at Seattle, Wash., has been given the additional duties of purchasing agent.

Mr. Garrett O'Neill, who has been assistant superintendent of the Wyoming division of the Union Pacific for many years, has resigned.

Mr. W. E. Stone has been appointed master mechanic of the Detroit, Toledo & Milwaukee, taking the place of Mr. J. W. Whitmer, resigned.

Mr. O. F. Jordan, for many years division superintendent of the Michigan Central at Jackson, Mich., has resigned to engage in other business.

Mr. C. E. Rickey has been appointed assistant superintendent of the Alabama Great Southern at Birmingham, Ala., vice Mr. H. B. Spencer, resigned.

Mr. A. F. Agnew has been appointed as roundhouse foreman on the Duluth, South Shore & Atlantic Railway at Marquette, in place of Mr. G. A. Gallagher, resigned.

Mr. W. H. Garlock has been appointed master mechanic of the White Pass & Yukon Railway, which is under construction in Alaska; headquarters at Seattle, Wash.

Mr. W. O. Sprigg has been appointed superintendent of the Lehigh division of the Easton & Amboy Railroad, with office at Easton, Pa., vice Mr. James Donnelly, resigned.

Mr. Frank Brown, heretofore assistant to the purchasing agent of the Baltimore & Ohio Southwestern, has been appointed purchasing agent; headquarters at Cincinnati, O.

Mr. H. T. Bentley, foreman of the Chicago & Northwestern Railway Shops at Belle Plain, Ia., has been appointed general foreman of the Clinton shops of the same road.

Mr. R. E. Emerson, formerly with the Mexican National, has been appointed master mechanic of the Louisiana & Northwest, the headquarters of which are at Gibsland, La.

Mr. W. E. Tew has been appointed assistant superintendent of the Montana division of the Great Northern, in place of Mr. J. W. Donovan, resigned; headquarters at Havre, Mont.

Mr. H. B. Spencer has been appointed superintendent of the Louisville division of the Southern Railway, with office at Louisville, Ky., taking the place of Mr. Geo. R. Loyall, transferred.

Mr. C. M. Stanton, general manager of the Jacksonville & St. Louis, has also accepted the position of general superintendent of the Litchfield, Carrollton & Western, vice Mr. T. W. Geer, resigned.

The headquarters of Mr. W. E. Killen, superintendent of motive power of the Chicago, Peoria & St. Louis and St. Louis, Chicago & St. Paul, have been changed from Springfield to Jacksonville, Ill.

Mr. T. W. Geer, superintendent of the Litchfield, Carrollton & Western, has resigned to accept the position of general superintendent of the Hutchinson & Southern; headquarters at Hutchinson, Kan.

Mr. Newman Kline, superintendent of the Seattle & International, has resigned to accept the position of superintendent of the Yellowstone division of the Northern Pacific; headquarters at Glendive, Mont.

Mr. F. P. McDonald, assistant superintendent of the Canada Southern at St. Thomas, has been appointed division superintendent of the Michigan Central at Jackson, Mich., vice Mr. O. F. Jordan, resigned.

Mr. B. S. McClellan has resigned as foreman of the car-building department of the Illinois Central at New Orleans, La., to accept the position of master car builder of the Fort Worth & Denver City; headquarters at Fort Worth, Texas.

Mr. George R. Loyall, superintendent of the Louisville division of the Southern Railway, has been appointed superintendent of the Asheville division of the same system, in place of Mr. W. O. Sprigg, resigned; headquarters at Asheville, N. C.

Mr. L. D. Button has been appointed superintendent of the Montana division of the Great Northern at Havre, Mont., in place of Mr. P. Nolan, resigned. He was formerly superintendent of the Kansas division of the St. Louis & San Francisco.

Mr. J. C. McQuay, an engineer on the Missouri division of the Northern Pacific Railway, has been promoted to the position of road foreman of engines on the Eastern district of the Northern Pacific. Mr. McQuay takes the place made vacant by the advancement of Mr. J. E. Goodman.

Mr. G. A. Gallagher has resigned the position of roundhouse foreman for the Duluth, South Shore & Atlantic Railway at Marquette, Mich., to accept the position of mechanical superintendent of the Duluth, Mississippi River & Northern Railway, with headquarters at Swan River, Minn. On the eve of his departure he was presented with a very handsome diamond ring, presented by the engineers and firemen as a token of the regard in which he was held by the men.

Mr. James E. Goodman, who has been road foreman of engines on the Northern Pacific Railway for several years, has been appointed general air-brake inspector of the same road. The office has just been created, and it is fitting that the incumbent is one whose proficiency in air practice, as well as in all the details pertaining to economical locomotive performance, should be recognized by the road that has profited by his services in other fields. The appointment was effective September 1st.

Mr. James R. Hatmaker, who was for fifteen years private secretary of Mr. Cornelius Vanderbilt, has opened offices in the Mills Building, Wall street, New York. He intends to give advice as an expert upon questions connected with railroads. We are persuaded that persons thinking of investing in railroad securities, or who require advice on matters relating to administration, profitable operation or reorganization of railway properties, would receive valuable assistance from Mr. Hatmaker.

Engineer George Gillen, of the New York division of the Pennsylvania Railroad, died at his home, No. 21 Perrine avenue, Jersey City, on the 10th of September. Mr. Gillen was credited with the longest term of service of any engineer on his division, having entered in the employ of the New Jersey Railroad and Transportation Company, which was the beginning of the Pennsylvania system, in 1844. The career of Mr. Gillen was an exceptional one, in that he never had an accident in that long experience as an engineer.

H. T. Higgins, cashier for the treasurer's office of the Chicago, Rock Island & Pacific Railroad, is dead from burns received by the explosion of a vapor bathing apparatus by which Mr. Higgins was endeavoring to secure relief from hay fever. The vapor bath had been purchased in the hope that it would drive away the disease. In some unaccountable manner the machine exploded while Mr. Higgins was in it. The shock was terrific, covering Mr. Higgins with scalding steam and leaving scarcely a portion of his body unharmed. Mr. Higgins had been in the employ of the Rock Island for eighteen years. He was fifty-two years old. A widow and two children survive him

EQUIPMENT NOTES.

Pullman's are building five passenger cars for the Baltimore & Ohio.

Pullman's are building eight passenger cars for the St. Louis & Southeastern.

The Rogers Locomotive Works have nine engines under way for the Illinois Central.

The South Baltimore Car Works are turning out 500 freight cars for the Baltimore & Ohio.

Barney & Smith have an order for four passenger cars from the Florida Central & Peninsular.

The El Paso & Northeastern are to have thirty freight cars built at the Buffalo Car Works.

The St. Charles Car Company are constructing one passenger car for the Centralia & Chester.

The Union Pacific are having one consolidation engine built at the Brooks Locomotive Works.

The Arkansas Midland are having ten freight cars built by the Missouri Car & Foundry Company.

The Chicago & Northwestern are having an order of 2,000 freight cars built at Haskell & Barker's.

The Buffalo Car Company are engaged on an order for 100 freight cars for the Delaware & Hudson.

The Murray-Dougal Company are building six freight cars for the Trinity Cotton Oil Company.

The Union Pacific, Denver & Gulf are having six freight cars built by the St. Charles Car Company.

The St. Louis & Southeastern are having five passenger cars built by the St. Charles Car Company.

The Texas & Pacific are having two six-wheel connected engines built at the Rogers Locomotive Works.

The Michigan Peninsular Car Company are building 300 freight cars for the Chicago, Burlington & Quincy.

The Union Pacific are having two six-wheel connected engines built at the Schenectady Locomotive Works.

The Indiana Car & Foundry Company are engaged on an order for 12 freight cars for the Mather Stock Car Company.

One six-wheel connected engine is being built at the Baldwin Locomotive Works for the St. Louis, Peoria & Northern.

One six-wheel connected engine is under construction at the Schenectady Locomotive Works for the St. Joseph Stock Yards.

The Baldwin Locomotive Works are building two six-wheel connected engines for the Leopoldina Railway of Brazil, and four of the same type for the Central Railway of Brazil.

The Baldwin Locomotive Works have under construction six-wheel connected engines for the following roads: One for the Chattanooga, Rome & Southern; two for the Kansas City Suburban Belt Line; one for the McCloud River; four for Halls Bay, and one for the Imperial Chinese Railway.

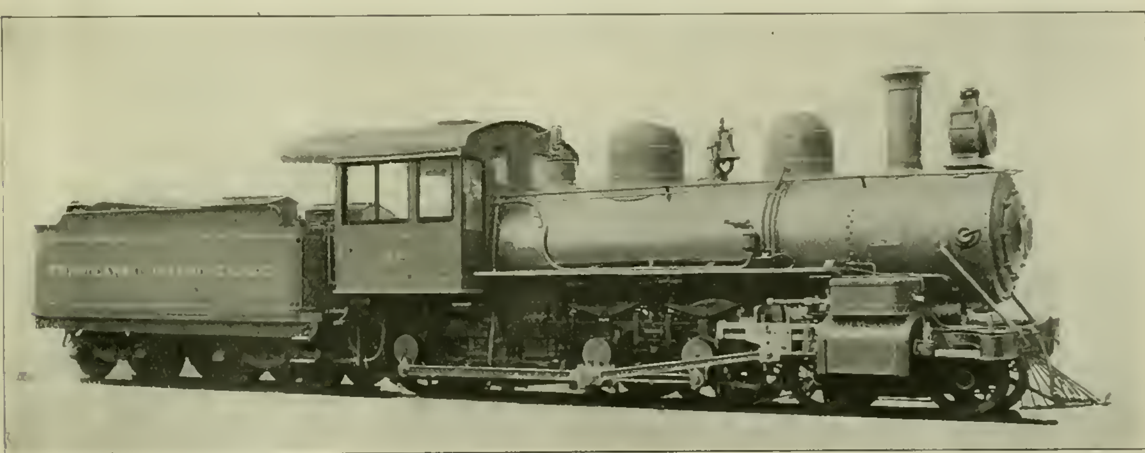
The Southern Railway has an order for 1,000 freight cars placed with the following builders: 200 at the Lenoir Car Works, 200 at the Elliott Car Works, 200 with the Illinois Car & Equipment Company, 300 with the Ohio Falls Car Company, and 100 with the Missouri Car & Foundry Company. In addition to these are ten passenger cars building at Barney & Smith's, and five passenger cars at Jackson & Sharp's.

Mexican Interoceanic Locomotive.

The odd-looking ten-wheeler hereby shown is one of a group recently built by the Schenectady Locomotive Works for the Interoceanic Railway of New Mexico. The road is narrow gage, the rails being only 3 feet apart, which accounts for the peculiar arrangement adopted of coupling up to drivers. Considering the gage of the track, the engine is quite heavy, weighing 90,500 pounds, 58,000 being on the drivers.

The cylinders are 17 and 27 x 20 inches. The driving wheels are 48 inches diameter outside of tires. The high-pressure cylinder has steam ports 15 x 1⅝ inches, and the low-pressure steam ports are 18 x 2. The inside ports are 2¾ inches wide. Allen Richardson valves are used, and have a travel of 5½ inches. The high-pressure valve has 1⅛-inch outside lap, and the low-pressure valve ⅞-inch lap. Both valves have ¼-inch inside clearance, and they are set with 1-16 inch lead in full gear. United States metallic packing is used for piston and valve rods. The engines are noted for their liberal wearing surfaces. The driving wheel journals are 7 x 7 inches; main crank pin journals are 5½ x 4 inches, and the side rod journals 3½ x 3 inches. The engine truck wheels have journals 4¾ x 7 inches. The boiler, it will be noted, is straight. It is 52 inches diameter, is made of carbon steel, and carries a working pressure of 200 pounds. The horizontal seams have butt joints, sextuple riveted. The firebox is 49 3-16 inches long, 44⅞ inches wide and 61 inches deep. The water spaces around the firebox are 3 inches in front and 2½ to 3 inches at the sides, and 2½ to 4 inches at the back. The crown sheet is supported by radial stays. There are 199 tubes in the boiler, 1¾ inches in diameter and 10 feet 7 inches long. There are 1,048.53 square feet of heating surface in the tubes and 81.94 in the firebox, making a total heating surface of 1,130.47 square feet. The grate area is 15.33 square feet.

The engines are equipped with Sellers latest improved injectors. They have two Crosby safety valves, one of them being cased. They have the American outside equalized brake on all drivers and Westinghouse 9½-inch air pump. They have Leech's sanding apparatus, Crosby chime whistle and thermostatic steam gage.



SCHENECTADY INTEROCEANIC LOCOMOTIVE.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Liquid Air, and Some Curious and Wonderful Facts About It.

Physicists have known for some time past, that the atmospheric air which we breathe when placed under great pressure and the heat extracted from it, is capable of being reduced to a liquid state. Until recently, however, liquid air has been a product of the laboratory, as its production requires special machinery, making it very expensive. Indeed, it is said that to produce the first ounce of liquefied air costs an English laboratory $3.000. A few months ago Chas. E. Tripler produced at a very low cost, by an improved and comparatively inexpensive process in his New York city laboratory, a considerable quantity of liquid air, and succeeded in bringing it within the limits of commercial utility. Mr. Tripler writes some interesting things about liquid air in the June number of the *Cosmopolitan Magazine*, from whch we draw largely for this article.

To liquefy air, it must be compressed by thousands of pounds pressure. One cubic foot of liquefied air represents about 800 cubic feet of atmospheric air. Imagine the air in a space nearly a sixth of a mile long, a sixth of a mile wide and a sixth of a mile high compressed into one cubic foot, and you have liquefied air, which is sky blue in color, and weighs 8⅓ pounds.

The power which lurks embodied in this innocent-looking azure cube is terrific. If it were properly controlled and could be evaporated by the engineer as he needed it, this cube of liquid, without the aid of pump or compressor, would easily supply the air brakes with sufficient pressure to drop the longest freight train down Tehatchapi, Soldier Summit, Tennessee Pass, Glorieta, Marshall Pass or Missoula Mountain, with more than enough to spare to run the Empire State Express from New York city to Buffalo. Should the engineer, at the foot of the grade, attempt to save the remaining liquid by pouring it into the main reservoir and securely plugging the hole, he would produce an exceeding healthy little boiler explosion for his heirs to describe in verse on his tombstone.

Liquid air is very cold, having a temperature of 312 degrees below zero, more than ten times as cold as melting ice or freezing water. If allowed to touch the flesh it will produce a "burn" which heals very slowly. Raw beefsteak, when immersed in liquid air, becomes frozen so hard that when struck it rings like a piece of bell metal. An immersed oyster becomes as hard as the oyster shell, and may be broken into fragments and pulverized into fine dust. Fruit and eggs when immersed are likewise affected.

Mercury, which ordinarily freezes at 40 degrees below zero, when immersed in liquid air, becomes frozen into a rigid bar resembling a block of tin. A tin cup immediately after being used to dip liquid air, becomes as brittle as thin glass. Steel and iron are likewise affected.

Ice dipped into a vessel containing liquid air will cause the liquid to boil. Water poured in causes the liquid to boil furiously, and a cloud of steam to escape. The water is almost instantly frozen into ice that is dry as chalk, and is stinging cold.

During an experiment a little liquid air was poured into a cup made of ice, and a steel wire placed in the liquid. Above the surface of the liquid one end of the wire protruded, and was touched by a lighted match. The wire burned brightly, giving off a pyrotechnic shower of brilliant sparks. After the shower, beads of steel were found in the bottom of the cup. Thus steel was actually melted, requiring hundreds of degrees of heat, in a crucible of ice.

Wool and hair felt, which scorches and crisps when ordinarily burned, flashes up like gunpowder when saturated with liquid air and touched with a flame. It is not moist or wet like water, does not dampen the flesh or clothes, only makes them very cold.

Unlike air under compression, liquid air cannot be confined in tanks or reservoirs, but must be held in tubs or other open vessels. The liquid is constantly evaporating, and the gas must be allowed to pass off, else it would continue to increase and cause a terrific explosion. Into a copper tube about the size and dimensions of an ordinary locomotive water glass, closed at one end, a little liquid air was poured, and a wooden plug instantly driven in. The force of the gas rapidly evaporating from the liquid was so great as to throw the plug nearly 300 feet high almost instantly.

The best form of receptable yet found for conveying the liquid from place to place is an ordinary uncovered, or loosely covered ice cream freezer. Owing to the extremely low temperature of liquid air, the insulation of the vessel holding it must be such as to protect it as much as possible from the heat of the surrounding atmosphere, else the liquid will evaporate rapidly. Even with the best possible insulation the liquid quietly boils and evaporates away. The fact that liquid air when confined becomes a high explosive, and when held in open vessels will dissipate, renders it dangerous and costly. Just what its commercial future is would be difficult to predict, but from the present outlook considerable taming must be done before anyone will care to trust it.

Increase in Air-Brake Equipment.

The Interstate Commerce Commission has just issued a document treating on the number of air brakes applied during the past year. It says: "The details as to equipment on June 30, 1897, show that the number of passenger locomotives fitted with train brakes was 9.899, or 83 more than the preceding year. The number of freight locomotives so fitted was 18,796, or 875 more than the preceding year. The number of switching locomotives fitted with train brakes was 3.666. The number of passenger locomotives fitted with automatic couplers was 4.687, the increase with respect to 1896 being 184. The number of freight locomotives fitted with automatic couplers was 4,192, the increase being 819. The number of switching locomotives fitted with such couplers was 741, or 147 more than for 1896. The number of passenger cars fitted with train brakes on June 30, 1897, was 33,078, and the number fitted with automatic couplers was 32,661, the increase in the one case being 665 and in the other 815. The number of cars in freight service fitted with train brakes was 453,688, or 74,630 more than on June 30th of the previous year. The number fitted with automatic couplers was 629.399, indicating an increase of 129,166. Of the total cars in service 492,559 on June 30, 1897, were fitted with train brakes, and 668,937 were fitted with automatic couplers, the increase for the year in the former case being 75.237; in the latter, 131,989."

It is with the deepest regret that we chronicle the death of John W. Shannon, one of the first and foremost air-brake experts in the country. Mr. Shannon was a self-made man, having been thrown upon his own resources early in life, and worked his way up to a trusted and responsible position with the Westinghouse Air-Brake Company. Mr. Shannon's death was the result of complications arising from heat prostration. He died in Buffalo, N. Y., September 10th. He leaves behind a host of friends who will be grieved to learn of his death.

One of the best preventatives of flat wheels is a good, thorough test of air gages.

Some Fine Features of the High-Speed Brake.

Although the high-speed brake was illustrated and described in this department about eighteen months ago, an inquiry from a correspondent (D. J. M., Jersey City, Q. and A., this issue) makes it necessary for us to further discuss that device, and bring out some features not touched upon in the original treatment of the subject.

Assuming that most of our readers are

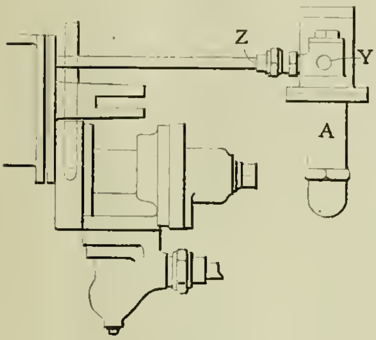


Fig. 1

fairly familiar with the high-speed brake, and referring those who are not to page 570, July, 1897, number, we will proceed immediately to answer at length the question of our correspondent, who asks why the more complicated form of valve used on the high-speed brake is necessary, if the small pop valve does the work satisfactorily, as it seems to do. In other words, why is valve *A*, in Fig. 1, necessary, if valve *B*, in Fig. 2, does the same work?

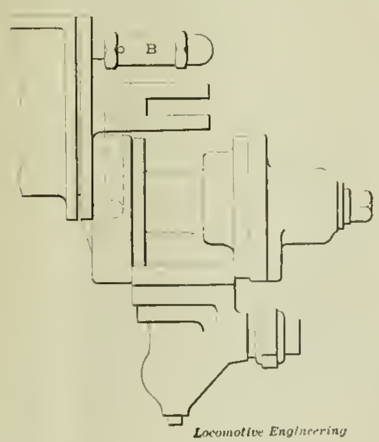


Fig. 2

It must be first understood that valves *A* and *B* do not do the same work. Valve *B* is an ordinary safety valve to be screwed into the oil hole of the cylinder of a car which is unexpectedly and temporarily placed in a high-speed brake train, to relieve the cylinder of the unusual high pressure, and thereby prevent wheels from being ruined by sliding. Valve *A* is an automatic reducing valve which, in an emergency application of the brake, will permit the cylinder pressure to reduce slowly during the earlier periods of the stop, and more rapidly during the latter part, thereby producing a high and slowly reducing pressure at the beginning of the stop when pressure is needed, and allowing it to reduce more rapidly towards the end of the stop when less is needed, and when the tendency of wheels to slide is greater.

Experiment has demonstrated that to stop a train in the shortest possible distance, the brake cylinder pressure must be high when the speed of the train is high, and must reduce as the speed reduces. It is to obtain this variable brake cylinder pressure that the automatic reducing valve has been devised. The 110 pounds train line pressure of the high-speed brake, in a quick-action application, fills the cylinders with about 85 pounds pressure, which the automatic reducing valve lowers, slowly at first, but more rapidly as the train approaches a standstill, to 60 pounds. Thus, at the be-

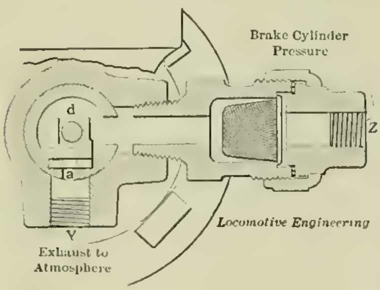


Fig. 3

ginning, we have a braking power of 125 per cent., which reduces in about the same ratio as the speed reduces, to 90 per cent. at the finish.

Now let us examine a little more closely the construction of the valve which so admirably and unerringly accomplishes this desirable result and renders it possible to cut off 450 feet, or nearly one-tenth of a mile, from the best 60 miles an hour stop made by the ordinary quick-action brake.

Fig. 3 is a horizontal section which shows how brake cylinder pressure enters at *z* and passes to chamber *d*, where it is controlled by slide valve 8.

Fig. 4 is a vertical section of the automatic reducing valve. Brake cylinder pressure in chamber *d* ends on the top of piston 4, and is opposed by the spring 11, which is adjusted at 60 pounds. When the brake cylinder pressure in chamber *d* becomes higher than 60 pounds, spring 11 is unable to resist the downward movement of the piston 4 and slide valve 8, and brake cylinder communication to the atmosphere is had through slide valve

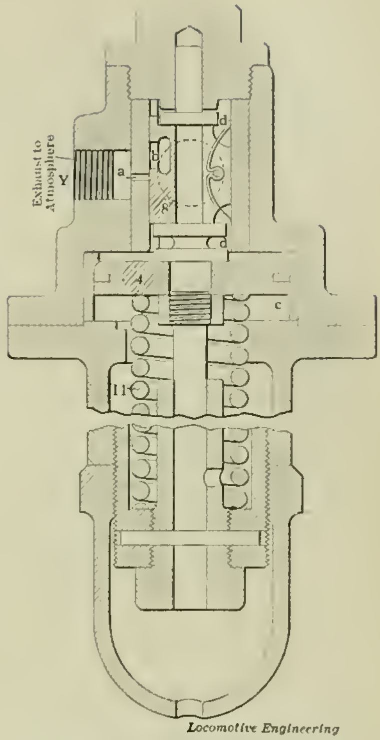


Fig. 4

port *b* and port *a* in the seat. As soon as the brake cylinder pressure in chamber *d* reduces below 60 pounds, the adjusting spring 11 returns the piston and slide valve to their normal positions, as shown in Fig. 4, and cuts off communication between brake cylinder pressure in chamber *d* and the atmosphere.

More closely approaching our objective point, and by reference to Fig. 5, we find piston 4 and slide valve 8 in their normal positions. Here the brake cylinder is either empty or contains insufficient pressure to force the piston and slide valve downward against the opposition of the

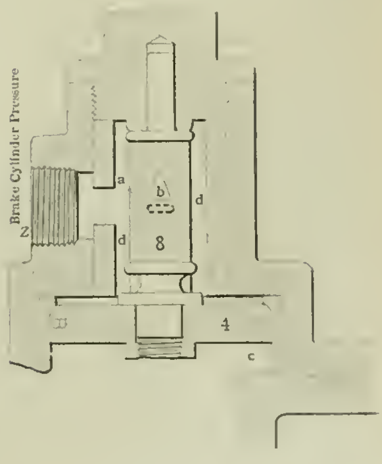


Fig. 5

adjusting spring, and bring ports *a* and *b* in register. Consequently no brake cylinder pressure can escape through these ports. If a brake gets less than 60 pounds in its cylinder, the pressure must all pass out through the release port in the triple as usual, for only that in excess of 60

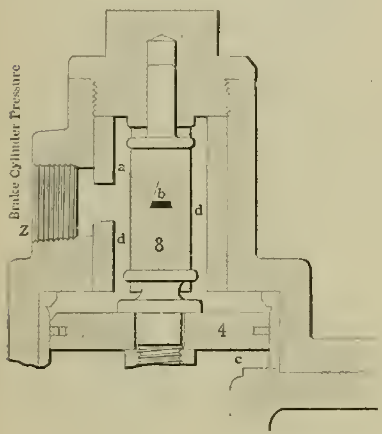


Fig. 6

pounds escapes through the automatic reducing valve.

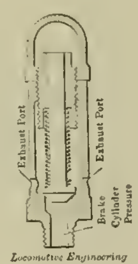
We now come to some very pretty and ingenious features of the high-speed brake. It will have been observed that ports *a* and *b* are peculiar in form, and instead of being circular, like ordinary ports, *a* is long and narrow, while *b* is triangular shaped. In the shapes of these ports, and their relation one to the other, lies the ingenious feature which enables the high-speed brake to perform its truly wonderful work.

In Fig. 6, more than 60 pounds has been made to pass to the brake cylinder by service applications. The piston and slide valve have descended, and ports *a* and *b* are in register, permitting brake cylinder pressure in chamber *d* to escape to the atmosphere through port *Y* in the back of the valve and not shown in Fig. 6. Observe that at this period, when the cylinder pressure is just a little over 60 pounds, the piston and slide valve have descended less than half stroke, and the largest possible opening is had by the wide base of triangular shaped port *b* being in full register with the long, narrow port *a*, which permits brake cylinder pressure to escape to the atmosphere about as rapidly as the triple valve in service position can pass it in from the auxiliary reservoir.

Ten pounds reduction in the 110 pounds train pipe pressure gives a full service application of 60 pounds. If, after releasing the brakes, a second application of the brakes should be called for before there has been time to recharge the reservoirs, there is abundant pressure yet stored in the reservoirs to make a second, and even a third, full service application, and still leave sufficient air pressure to make an emergency stop equal to that of the ordinary quick-action brake. Thus an immense advantage is obtained with the high-speed brake even in service stops.

In an emergency application of the brake, the piston and slide valve are driven down their full traverse, as shown in Fig. 7. Observe, now, the ports *a* and *b*. The apex of the triangular port *b* now covers but a small part of port *a*, and the train pipe and auxiliary reservoir combine to produce 85 pounds cylinder pressure, which must reduce slowly to 60 pounds through the restricted passage offered by *a* and *b*. As the pressure reduces, the spring forces the piston gradually upward, making the restricted opening larger each succeeding moment until a full opening is had. Thus at the highest speeds during the stop, the escape of pressure through the triangular port is slower, and is more rapid as the piston gradually ascends and a wider portion of the triangular port is presented.

Another pretty feature to observe in the high-speed brake is, that during service application, when the speed is comparatively low, and the danger of wheel sliding is greater, the automatic reducing valve reduces brake cylinder pressure



BRAKE CYLINDER ESCAPE VALVE.

more quickly than in emergency when the speed is apt to be high, and there is nothing to fear from wheels sliding. Of course, the difference in port opening, as explained, largely controls this reduction, but not altogether, for in an emergency application of the brakes, the triple valve makes its extreme traverse, and the restricted escape passage in the automatic reducing valve is obliged to vent both brake cylinder and auxiliary reservoir, as they are then in communication. In service stop, however, the brake cylinder alone is vented, as it is separated from the auxiliary reservoir by the slide valve of the triple.

It will be seen, therefore, that the ordinary poppet valve, shown in Fig. 2, cannot perform the function of the cleverly devised automatic reducing valve of the high-speed brake.

❀ ❀ ❀

Cleaners should never remove the packing ring from the triple valve piston, for sufficient cleaning can be done when the ring is left in its groove.

CORRESPONDENCE.

Repairing Triple Valves and Angle Cocks.

Editors:

Having read F. B. Farmer's article on the "Feed Valve Attachment," which is certainly information to Air-Brake Men, I would suggest that, through your columns, some air-brake repairman write us an article on repairing plain and quick-action Westinghouse triple valves, concerning the repairs of groove in piston, how to maintain standard width of ring, etc.; what is mostly done with cylinder when out of round, and diameter larger in center than at ends, and method mostly in use for grinding ring in cylinder; also results obtained from tools used by hand for truing out slide-valve seats in plain and quick-action triples.

I have had an experience recently with a plain triple, which I repaired by truing up slide valve and seat; new ring in cylinder, and ground plug cock. I tested the triple on the rack, and found, after several attempts, to have bad leaks at exhaust port in full release. In service and emergency the triple was perfect with soapsuds. I tested the plug cock by placing two gaskets in triple and turning drain cup so as to shut off port to auxiliary, moved piston to full release and put ½-inch plug in brake cylinder connection of triple, and found plug cock tight; but by lapping brake valve, after an 8-pound reduction, brake cylinder pressure would hold for a while, and then slowly go up to 50 pounds by about 5 pounds at a time, holding a while after increasing each 5 pounds. Would like to know cause of blow.

Also would like to hear from some reader on angle cock repairs, how to

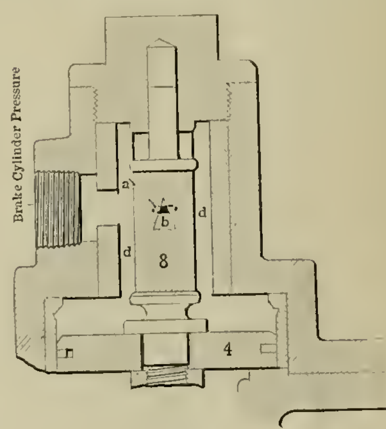


Fig. 7

make best time, what to grind with to guard against scratches, and what results are had from machine grinding and whether speed of machine has anything to do with the same.

F. G. SHAFFER.

Chambersburg, Pa.

Coupling for Train Pipe and Signal Pipe.

Editors:

On passenger trains of the present day if the train pipe were to become disabled from any cause, so that the air brake could not be used on that particular car; naturally the first thing thought of would be to switch that car behind, so that the air brake could be used to get to the terminal station.

The writer has often thought, how many engineers and trainmen would think of any other plan to get in, using the brake, and not switching the car behind.

The majority of railroads in the United States are now using the train signal apparatus. Now if each passenger crew, or passenger locomotive, were supplied with a pair of 1-inch hose, with the train pipe couplings on the end, and the signal pipe nipple on the other end, they could be placed on the signal pipe, and that could be used for the train pipe on that car.

The ¾-inch pipe being used for a train pipe, might make the application of the brake a little slower, but it would be better to go into terminal with the air brakes working than it would be to lose time switching the car behind; and another thing, the pipe might become disabled between stations where there was no side track. It is better to go in with a disabled train signal than it would be with disabled brakes.

There is no doubt that a great many railroad men will laugh at this idea, by saying that this would not happen once in a lifetime, and it would be easier to switch the car behind, etc. Now, if it were to happen only once in five years on one railroad, it would seem to pay that road to go to the slight expense of an extra pair of hose and couplings of this kind to each passenger crew.

Several years ago the writer was instructing some engineers and crews on a certain western road. At that time the passenger equipment was the old slow-acting triple valve, with the ¾-inch pipe. Some of the cars were equipped with the signal, but it was not being used at that time.

One day we were going down a 30-mile grade, with a maximum grade of 2 per cent. From some cause the pin broke behind the tender. The couplings were stiff, and instead of parting, pulled the stop cock off of the end of the pipe.

There was no thread left to screw on a new cock, and we had no tools to get the piece of pipe out of the cock. The conductor insisted on going in without the brake. But the writer had posted the engineer and the hose was changed without any trouble, as the pipes were all ¾ inch in diameter, and we went in on time.

H. C. Frazer.

San Francisco, Cal.

The Retaining Valve Failed.

Editors:

Here is a little story for you. In 1883, the writer was equipping the freight cars of a certain western road with the automatic brake. We were running on a level division where there would be no use for the pressure retaining valve. The writer was riding in the caboose, giving instructions to the trainmen. At that time the ten pound valve was being used.

Had explained to the train men the use of this valve. Had told them it would not be necessary to use them on this division, and I thought that I had got them to understand all their duties connected with the brake.

At the next station there was some switching to do, and I stood and watched the train men close stop cocks, uncouple hose, etc. There were six cars to be kicked into a side track on which some other cars were standing. The brakeman gave the signal, pulled the pin, and got on top of the cars to set the hand brake, as I supposed; but the first thing he did was to turn up a pressure retaining valve, and as he found they were not stopping, went and turned up another one. The consequence was the cut run down into the other cars, and there were about 8 draw heads to put in. When the brakeman got to where I was, he said that those cocks would not hold ten pounds, would not hold anything, in fact. After leaving that station, I commenced at the beginning of my lesson again, and finally got them to understand when the pressure retaining valve would work.

H. C. Frazer.

San Francisco, Cal.

Mr. Farmer's Feed-Valve Gage.

Editors:

I wish to ask you to send me one of Mr. F. B. Farmer's new gages for the different parts in the feed-valve attachment that I see in this month's number in your Air Brake Department.

I think they are just the thing to maintain standards.

Samuel N. Sewsey,
A. B. Repairman, B. & M. R.

Lyndonville, Vt.

[We cannot supply the gage, and do not believe Mr. Farmer has had any made except the one he uses himself. The measurements are given on the cut, and as there is no patent on the gage, anyone can make a gage for himself.—Ed.]

At the Nashville convention of Air-Brake Men, Mr. Thomas Cope, of the Westinghouse Air-Brake Company's shops, said that when a triple piston packing ring is once removed at the works, it is never used again.

A circular from the office of the superintendent of motive power of the Northern Pacific Railway Company, under date of August 30th, says: "Mr. J. E. Goodman is hereby appointed general air-brake inspector, with office at St. Paul. The general air-brake inspector will have charge of the inspection of all air-brake equipment on engines and both freight and passenger cars, as well as the instruction and examination of engine and train men in the use of the air brake, including reporting defects in this apparatus. He will inspect and check the work of car inspectors and repair men done on air brakes and attachments, and will also inspect the work done by shop repair men on all air-brake apparatus, reporting to the proper master mechanic matters relating to inspectors and repair men. He will visit each division at stated intervals and arrange with the division superintendent and master mechanic for the instruction of train and engine men in the knowledge and handling of the air brake on trains and engines, and will report the results of such examinations to the division superintendent and master mechanic, respectively. This appointment will take effect September 1, 1898."

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(90) J. K. H., Plainfield, N. J., asks:

Why is it a train always breaks in two when a hose bursts between the cars? A.—It does not.

(91) W. J., Marion, N. J., asks:

How long can the average retaining valve be expected to hold? A.—The retaining valve is only intended to hold the train in check while the auxiliaries are recharging, which should be from ten seconds to thirty or thirty-five.

(92) L. W. K., Truro, N. S., Canada, writes:

A D-8 brake valve gives emergency application to driver brakes in service stop. What is the cause? A.—Either the piston and slide valve in the driver brake triple, or the equalizing piston in the brake valve needs cleaning and oiling.

(93) W. J., Marion, N. J., asks:

Should the brakes in freight service be applied until whole train has passed over top of hill? If so, is there not danger of its breaking in two? A.—It is better to get the whole train over the summit before applying brakes, else the rear brakes may pull back and break the train in two.

(94) W. J., Marion, N. J., asks:

How would you handle train on hog-backs and sags in road? A.—Keep the train either bunched or stretched as near as possible at all times. Avoid the use of hand brakes on the caboose and rear cars. Manipulate the brakes and throttle so as to let the slack run in and out as gently as possible.

(96) M. C., Bradford, Pa., writes:

I have had trouble with the new main valve (dished heads) for 8-inch pumps. I find the rod upon which the heads are mounted bends occasionally. Cannot account for it. Will you kindly explain it? A.—You will probably find your difficulty in the lack of clearance between the lower end of the stem and the stop in the center piece.

(97) R. M., Jersey City Heights, N. J., asks:

Are there any objections to the use of hand-brake staff and wheel at each end of the freight car? I am told there is a loss of power in using them. A.—With brake rigging designed in accordance with M. C. B. requirements, there is no objection to a hand brake on each end of a freight car, and there is no loss of power.

(98) G. S. L., Junction City, Kan., writes:

D-8 valve works awful hard; oil does not relieve it. If I have any number of cars of air from fifteen to forty, the valve works beautifully; otherwise it works hard. What is the cause of this? A.—The valve should work as easy with a short train as with a long one, and *vice versa*. Oil the gasket between the key collar and top cap, and the valve will work much easier.

(99) W. D., Newark, N. J., writes:

In reference to Question 84, why will not slack go out back of hand-brake cars as well as ahead? I would suppose that when the cars having hand brakes set on were jerked ahead as the front cars surge along, that slack behind would run out also. A.—In making a stop, the hand brakes need not be let off until final stop is made. The engineer can release and apply the air brakes and regulate the stop. Thus the hand brakes will hold in the slack.

(100) W. D., Newark, N. J., asks:

1. What percentage of train should have air brakes on (if handled by air) to insure even ordinary safety in handling? A.—1. The percentage varies from 15 to 100 on different roads, according to the character of the road. 2. Could any kind of a train, either passenger or freight (wholly or partly equipped), be held down a grade five miles long, 130 feet to the mile fall, and stop at foot of hill, all with one application? A.—2. Not without the assistance of other brakes than air brakes.

(101) W. D., Newark, N. J., writes:

Referring to Question 85, why would the wheels having hand brake on part of time and air brake part of time be more liable to crack than those having hand brake on all the time? The hand brake is usually pretty tight on the latter cars. A.—When hand brakes are set on air-braked cars they are usually allowed to remain set until stop is made. Thus the wheels, being subjected to pressure of both air and hand brakes, will heat more and be more liable to crack in cooling off.

(102) W. J., Marion, N. J., asks:

How would you handle train on 140-foot grade, five miles long, no "let-ups," and stop to make at bottom, perhaps? A.—With a passenger train, catch up the train soon after pitching over, use all retaining valves, recharge on curves where practicable, keep the train line pressure near the maximum, and don't try to make express-train time down the grade. On freight trains, do the same, as near as possible, using hand brakes immediately back of air cars, if any hand brakes are necessary.

(103) W. J., Marion, N. J., asks:

Is it proper at foot of a grade where no stop is to be made, to reverse engine to hold slack in while brakes on train release so as to avoid breaking in two? And would you reverse before or after moving handle to release position? A.—There is not the tendency to break in two that the question implies. It is not the practice to reverse the engine to hold in slack, but the release is made the same as on a level. Steam should not be used before rear brakes are off. More trains are broken in two from this cause than any other.

(104) L. W. K., Truro, N. S., Canada, asks:

With train pipe exhaust plugged, can train pipe pressure escape from preliminary exhaust in service stop? If not, what will cause the brake to apply, other than train line leaks? A.—With the train pipe exhaust plugged and the brake valve handle in service position, train pipe pressure will pass slowly by the equalizing piston packing ring to chamber D, thence out through the preliminary exhaust port to the atmosphere, and the brakes on a light engine or very short train may apply.

(105) W. D., Newark, N. J., asks:

1. How long should be required for recharging from 60 to 70 on a twenty to twenty-five car train? A.—1. It would vary with the excess in the main reservoir. With 100 pounds, from fifteen to twenty seconds would be a fair estimate. 2. How long from 50 to 70 on same train? A.—2. Would again depend on amount of excess. Probably from twenty-five to thirty-five seconds. 3. Would it take twice as long on a forty to fifty-car train? A.—3. It would take more than twice as long, owing to the greater length of train and head cars charging more rapidly than those farther away from the engine.

(106) J. K. H., Plainfield, N. J., asks:

Why is it the exhaust from the angle fitting of the D-8 valve on engine alone, when thrown into release, is not as strong as on the E-6 valve when that is thrown into release, after, for instance, standing on turntable with brake applied? A.—The strength of the exhaust at the angle fitting, when brakes are released, is dependent upon the difference between the main reservoir and train pipe pressures. The governor with the D-8 valve is connected to train pipe, and with handle on lap the main reservoir can run up almost to steam pressure. On the E-6 valve the governor is connected to the main reservoir and that pressure is limited. Consequently a higher main reservoir pressure is had with the D-8 valve, and also a greater flash.

(107) R. M., Jersey City Heights, N. J., writes:

In "Diseases of the Air Brake" it was said that an objection to the old freight triple was, that it was not given travel enough to allow the brake to apply in case of a broken graduation pin. Did not this piston move down far enough for the slide valve to uncover entirely the port leading to the brake cylinder, same as present plain triple does in emergency? A.—This triple passed air from the auxiliary reservoir to the brake cylinder through the graduating port in the slide valve in both service and emergency applications. If the graduating pin broke, the passage was blocked and the brake could not be applied. The manufacturer has called these triples in and exchanges the new quick-action triple for them.

(108) R. M., Jersey City Heights, N. J., writes:

Do not understand your statement in the August LOCOMOTIVE ENGINEERING, in regard to the "elongated port, Question No. 75. I have a D-8 having this recess, yet the feed through the direct or full release passage, by which I presume you mean the one noted as *a* in rotary and *b* in seat, is not cut off until the port to excess valve is fully opened, and the instruction book diagram with movable piece shows that port to excess valve is half open at least before the direct supply port is entirely cut off from cavity. A.—This is our mistake. We should have said that there is no necessity for providing against a lap position between full release and running position with the E-6, as there was with the D-8. You are correct.

(109) L. W. K., Truro, N. S., Canada, writes:

Please explain why some driver brakes will release after being applied in the emergency, the tender brake remaining set. In the service application the driver brake will stay set all right. A.—If, when the emergency stop is made, the brake valve handle is left in full emergency position, the release is due to a leaky piston packing ring and poor leather gasket against which the piston should make a tight joint. On the other hand, if the handle be returned to lap after a short dash to emergency position, and the driver brake whistles off, it is due to the pressure in chamber D, which is not used in emergency applications, leaking past the equalizing piston of brake valve into the train pipe and forcing the triple to release position.

(110) R. M., Jersey City Heights, N. J., writes:

What is the capacity of equalizing reservoir under running board? Have always understood it was about 700 inches. As it is about 9¾ inches diameter inside measurement, it would have to be 9 inches long to give this capacity, while I find it is "dished in" about 2¼ inches outside measurement on each end, showing not much more than 7¼ inches inside measurement, which will give nearly 150 inches less than 700. Please correct me. A.—The capacity has been conveniently rated in round numbers at about 700 cubic inches, although the figures given are not exact, as the "dished" heads make the computation difficult. Perhaps the easiest way to get the exact volume is to take off the reservoir, fill it with water and measure the water. One gallon of water contains 231 cubic inches.

(111) J. K. H., Plainfield, N. J., writes:

The exhaust at the angle fitting when brakes are released is said to be due to train line charging quicker than middle chamber. Someone asked some time ago why the hole to middle chamber could not be made larger to assist in overcoming this, and you answered that it was already as large as it could be made; but gave no explanation. It seems to me it could be made much larger, unless there is some objection to doing so, either by a larger hole, or, if that would interfere, by elongating it, or drilling a hole or two right behind the present one. A.—If the equalizing port were drilled larger, or were elongated, or were reinforced with other ports nearby, interference would be had with the combinations of ports in the other positions of the rotary valve, and greater annoyance and trouble would be experienced. Possibly some function of the valve would be destroyed.

(112) D. J. M., Jersey City, N. J., writes:

On some of the trains running out of here which have the high-speed brake, I see a little pop valve on some of the cylinders. This pop valve is smaller than the pops on the regular high-speed brake cars, and screws right into the cylinder head. What is the difference between the two kinds of pops, and why are the big ones necessary if the little ones do the work? A.—The small pop valve referred to is a temporary device, screwed into the oil hole, for preventing too high accumulation of pressure in the brake cylinder of a car which has been placed in a high-speed brake train on short notice, and is not supplied with the high-speed automatic reducing valve. The small pop valve is simply a safety valve, while the large valve on the high-speed brake car is an automatic reducing valve. The work performed by the two valves is widely different. For further information, see article elsewhere in this department.

(113) R. M., Jersey City Heights, N. J., writes:

I notice in looking over the test stops, as shown on page 151, 1895 Proceedings of Air-Brake Men's Association, in connection with truck brakes, that in emergency, with the truck brake either cut in or out, the best stop was made with the six-car train. I supposed such was the case in service also, but these tests seem to show that with the truck brake either cut in and out, the best service stops were made by the three-car train. Will you kindly give the reason why this should be? A.—In the emergency stop, the quick-action triples on the six coaches braked at 90 per cent., almost instantly gave full braking power and assisted largely in holding the engine and tender. In the service stop it took less time to reduce the train pipe pressure on the three-car train than the six-car train, and maximum brake power was reached quicker with the short train. In this latter case the engine and tender did their full share of the holding.

(114) J. K. H., Plainfield, N. J., writes:

Will you kindly oblige several readers by answering the following question? Given a train of thirty-five cars, some loaded, some empty; the first ten equipped with air, which is used to stop. Could a better stop be made with this train at a given speed, beginning to apply at a given point, if the ten cars having air brakes were loaded cars, than could be made with a similar train, all conditions the same, excepting that the ten air-brake cars are empty? A claims the loaded cars ahead would stop train best, as with empty ones ahead they would be liable to slide. B says if conditions are proper, as they should be, empties should not slide. C claims it makes no difference, as there is a certain weight to overcome, and a certain power exerted by ten cars to overcome it, whether loaded or empty. B says empty cars ahead would be of more assistance than loaded. Both service and emergency applications to be considered. A.—If the brake gear on the cars is properly designed, the wheels will not slide to any considerable extent. The shorter stop could be made if the ten air-braked cars were empty. The loads in the ten cars would not assist in holding, but instead would push.

John M. Toucey.

John M. Toucey, so well known through his connection with the management of the New York Central, died September 23d. Mr. Toucey entered railway service in 1848 as a station master on a New England railway. In 1855 he went to the Hudson River and entered train service. He was a conductor for some time, and in 1867 was made assistant superintendent of the road. He rose rapidly to the position of general superintendent, and in 1890 was made general manager.

Through the changes that followed the election of Mr. Calloway to be president of the New York Central, the position of general manager was abolished, and Mr. Toucey retired on a pension. Mr. Toucey was a remarkably good railroad official, and was exceedingly successful in his handling of men. When any dispute arose between the company and the employés, Mr. Toucey always tried to get in direct communion with those who were feeling discontented, and he nearly always succeeded in settling disputes amicably. He was the inventor and patentee of several railway appliances, and a signal system which he helped to work out was used by the New York Central for many years.

The death of Mr. Toucey is a striking illustration of the danger that comes to men who have led very active lives when they suddenly retire from business. Although he was seventy years old, he was a hale, healthy man—one who might have been expected to live ten or twelve years more—but the sudden change of habits wore upon him so that the illness which terminated in his death overtook him. He was the kind of man who makes hosts of friends and no enemies. He took a very keen interest in the pages of LOCOMOTIVE ENGINEERING, and was always ready to discuss something that had appeared therein with the chief editor when he called. He was strongly critical, but always was good natured with it.

JOHN M. TOUCEY.

Mr. Toucey was noted for the interest he took in young men and the encouragement he gave them to make their way upwards. He had three favorite words which he used to express the requirements that would ensure success. They were "will-ability, do-ability and stick-ability." The attributes described in these words had made Mr. Toucey what he was, and he was ever ready to reveal the secret powers that had raised him from a station master to be general manager of one of the greatest railroads in the world.

Combustion isn't such a hard thing to understand if you get a book that explains it in plain language. Sinclair's little book on this subject is the best in this respect.

Another Westinghouse Long Distance Transmission Plant.

Contracts involving ten thousand horse-power are not common. Especially is this true when the agreement is to transmit this enormous amount of power over a distance of 45 miles. And when the contract further stipulates that the losses in generators, transformers and line shall remain normal, notwithstanding the difficulties involved, the agreement then becomes of still greater interest.

Such a contract has just been executed by the Westinghouse Electric & Manufacturing Company, in which they agree to comply with the above conditions. The plant is for the Snoqualmie Falls Electric Power Co., of Snoqualmie Falls, Washington.

The power station is to be located at Snoqualmie Falls, 45 miles from Tacoma and 31 miles from Seattle, to which places the current is to be transmitted and then utilized by Westinghouse motors.

The contract involves the building and delivery at above points, of four three-phase, rotary armature, generators, having a normal aggregate capacity of 6,000 kilowatts, and which are to be direct connected to water wheels; two 75 kilowatt kodak exciter dynamos also to be direct connected to water wheels; high and low potential switchboards for main power station and sub-stations at Seattle and Tacoma, involving 76 marble panels with all necessary instruments, switches, etc.; high tension oil insulated static transformers having an aggregate capacity of 10,875 kilowatts; rotary transformers with a total output of 2,700 kilowatts and 6 type "C" motors developing 1,600 horse-power, with adequate lightning protection at both ends of the line.

These machines when installed will make available for industrial, railway and lighting purposes the power of Snoqualmie Falls. The line potential will be 25,000 volts, and its current will be carried over bare aluminum wires to sub-stations where lowering transformers will sufficiently reduce the voltage for safe transmission within the corporate limits of the two cities.

The Baltimore & Ohio Railroad is about to indulge in an experiment of using the telephone for long distance communication. Work will begin in a few days on the construction of two new copper telegraph lines between Baltimore and Pittsburg, 340 miles, and they will be so arranged that when the necessity arises they will be available for telephonic communication. One of the wires will be extended as far as Newark for telegraphic use. A new line has also been constructed between Columbus and Cincinnati. It will take 800 miles of copper wire weighing 166 pounds to the mile to complete the work.

Wilson Eddy.

Another of the pioneers of locomotive building has dropped from the ranks and we are compelled with the deepest regret to record the death of Wilson Eddy at the age of 85. He began work on railroads in 1840, and retired in 1880 in favor of his son, making forty years of active service.

In 1850 he was made master mechanic and then began to build what are known as the "Eddy" engines, the last of which the writer saw in Worcester a few months ago.

The first of his locomotives, the Addison Gilmore, made a great record and marks one of the epochs in American locomotive building.

It had outside horizontal cylinders, which was then an untried scheme. It had a single pair of driving wheels, a four-wheel truck and a small pair of wheels behind the firebox. There was no cab, it then being considered necessary for the engineer to stand outside where he could watch his machine. There was, however, one comfort allowed the engineer, that of being able to oil the cylinders by means of a tube from the footboard. The new locomotive was supplied with headlight, whistle and bell and in many ways resembled the locomotives seen every day by the present generation. The Addison Gilmore first attracted wide attention in a tournament held in Worcester October 1 and 2, 1851, in which it outstripped competitors and won a diploma and gold medal for its speed. It ran nine miles in 11 minutes, 29 seconds, making the fifth mile in a little over one minute.

WILSON EDDY.

Mr. Eddy called his second locomotive the Whistler. It was patterned after the Gilmore, but had two pairs of driving wheels. The large wheels were again used, and when the mail trains between Boston and New York were started, the Whistler was used, and soon established a record of 58 minutes between Springfield and Worcester. As railroading advanced Mr. Eddy's engines were often put to severe tests, and always held their own. A series of trials was made in August, 1876, which established the superiority of the Eddy engines in drawing capacity and fuel economy. The Boston railroad shop, which controlled the rolling stock between that city and Worcester, was not merged with the one in Springfield when the roads were consolidated in 1867. The local shops under Mr. Eddy still controlled the stock between Springfield and Albany, and gradually increased in importance. Locomotives gradually grew heavier, and Mr. Eddy's last one weighed 41 tons.

Any old railroad man in New England is familiar with these engines, and many of them tell with pride of the performances of the "Eddy clocks" as most of the boys called them.

In 1856 he went to Russia to build locomotives but the plan failed and he returned to New England.

Warming Passenger Coaches.

It is still the practice on some foreign roads to use the warming pans on all passenger trains, except perhaps the flyers. To read anything about these "refrigerators," as they are sometimes called over there, gives but a faint idea of the discomfort to passengers, attending the removal or installation of them in order to make a passenger comfortable. It is quite strange to us on this side, though, that such old-fashioned methods of warming a car should be so piously adhered to at this time, when steam heat can be so easily and cheaply applied, as has been proved on the same roads that are wedded to the pan practice. There is, however, a phase of the warming question right here, that is fully equal to anything yet produced by the coldest pan, and that is the torridity induced by an indolent train hand on our steam-heated trains. Inattention to equalization of temperature in the car, as we often know it here, is probably more harmful to a passenger than the cold pan; but in the rectification of the two evils, the pan should be first to go, because it is not in accord with the spirit of modern railroading.

The Baldwin Locomotive Works are filling an order for one six-wheel connected engine for the Mobile & Birmingham, and for fifteen of the same type for the Kansas City, Pittsburg & Gulf.

Mr. Nat. C. Dean, representing jointly, heretofore, the Fox Pressed Steel Equipment Company and the Carbon Steel Company, has resigned as agent of the former, and will devote his entire time in the future to the interests of this company as Western sales agent, with offices in Chicago (1409 and 1411 Fisher Building) and New York.

WHAT YOU WANT TO KNOW.

Questions and Answers.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(74) W. H. P., Savannah, Ga., writes:

In your comments on the new Dickson eight-wheeler in the April issue, I notice that direct ratio is used in all the calculations except that for firebox heating surface to total heating surface, which is worked by inverse ratio. Not being much of a mathematician, I would be glad if you would explain why this is. A.—The result as shown gives the "ratio of total heating surface to firebox heating surface," and is correct. The compositor was at fault in transposing the types, which should read as above.

(75) G. L., Junction City, Kansas, writes:

Am using a Friedmann injector, and every time the engine is reversed the injector breaks. All joints are tight and water passages are clear. What is the cause of it, and how can I remedy this action? A.—The causes for the above performance are too obscure at this distance to suggest a remedy. It may be due to a short dry pipe, which would be likely to ship moisture and thus cause the break, or it may be due to surge of water in a small boiler, which would also disturb the action of the injector. The question was referred to the makers of the injector, who could give no further information than is embodied above. If the dry pipe is large enough and located so as to receive dry steam, there is no reason why an injector in working order will not perform properly.

(76) M. F. J., Colorado Springs, Colo., asks:

1. What is the reason that copper flues and fireboxes are almost universally used in England, and steel and iron used for the same purpose in America? A.—1. Copper is largely used, presumably because of its great heat endurance and high conductivity. Its liability to blister and injury from overheating is less than with mild steel or iron. Steel is used in America because it is believed to be the best material for the purpose. 2. What are the points in which the link motion has advantages over the Walschaert gear, and the latter over the former? A.—2. The link motion has fewer working joints to maintain than the Walschaert gear, and by means of the variable cycle of events in the stroke due to shifting the position of the link, it has proven to be a most admirable device for controlling steam distribution in locomotives. (See Halsey's "Locomotive Link Motion.") The Walschaert gear gives the valve a constant lead, which is not desirable in a locomotive, and an equalization of cut-off is very easily obtained; this motion has no advantages over the well-designed link motion. 3. I am told that an air pump exhausting into the tank makes the water almost boiling hot; would not this interfere with the working of an injector? A.—3. If hot enough, yes. At a boiler pressure of 150 pounds an injector will not handle water at a much higher temperature than 120 degrees. 4. Can you by a simple diagram show the working of the Stevens valve motion, formerly, and to some extent at present, used on the Southern Pacific Railway? A.—4. We shall show the Stevens gear in the near future.

(77) J. B. C., Richmond, Va., asks:

1. When steam is admitted to a vessel colder than itself, where does the water of condensation go; does the water run down the walls to the lowest part of the vessel, or does it remain pressed against the surface, where it is condensed? A.—1. The water of condensation being denser than the steam, will fall to the bottom of the vessel. 2. If a locomotive has just enough adhesion to prevent its wheels, of 6 feet diameter, from slipping on the rail with a given mean effective pressure on the pistons, would the same engine with the same adhesion be capable of pulling one-third more train without slipping, at the same rate of speed, if the drivers were increased one-third in diameter and had one-third more mean effective pressure? A.—2. No, because the ratio of mean effective pressure to diameter of driver is the same in both cases, and the pull on the draw bar therefore remains the same. 3. If heat having a temperature of 500 degrees be applied under a boiler having no means for the steam to escape, would the steam finally rise to the temperature of the heat under the boiler; if not, why? A.—3. No, for the reason that well-arranged heating surfaces will only transmit about 75 per cent. of the theoretical quantity of heat due to the complete combustion of fuel on the grate. 4. If with an engine having a single pair of drivers and a single pair of front truck wheels, with a weight on drivers of 100,000 pounds, and a weight on truck of 25,000 pounds, it is supposed that a weight of 20,000 pounds was hung from rear coupling pin of engine and that the distance from said pin to center of driving axle is 6 feet, and the distance from center of driving axle to center of truck is 18 feet, what would be the weight on each pair of wheels? A.—The reaction of the support under the driving wheels will equal $100{,}000 + (20{,}000 \times 24 \div 18) = 126{,}667$ pounds, and that under the truck wheels will equal $25{,}000 - (20{,}000 \times 6 \div 18) = 18{,}333$ pounds.

(78) T. J. T., Sayre, Pa., asks:

1. In case of low water, which will first burn out, the top row of flues or the crown sheet? A.—1. The crown sheet. 2. About what is the difference in temperature of the hottest place on the crown sheet and the top row of flues? A.—2. There is practically no difference. 3. How often should a boiler be cleaned when using average water? A.—3. The interval of time elapsing between wash-outs of a boiler will depend on the scale-producing elements in the water; there is no average water. On some roads where water is soft, the boilers are never washed out, while on other roads it is necessary to wash out the boiler at each end of the run. 4. About what power does it take to strip the thread on a 1⅛-inch bolt twelve threads to the inch, the nut being 1⅜ inches thick and the bolt and nut being at a dull red heat? A.—4. From experiments made by Fairbairn to determine the effect of heat on the strength of wrought iron, it was found that good rivet iron had a tensile strength of 35,800 pounds at a red heat. Taking that figure as a basis, and the shearing strength to be 0.7 of the tensile, we have 25,088 pounds per square inch of surface sheared as resistance to stripping the thread. The total force necessary to strip the 1⅛-inch bolt equals $25{,}088 \times 4 = 100{,}352$ pounds. 5. In case of low water would the crown sheet burn out or blow down, the bolts and bars being in good condition? A.—5. A crown sheet will either bag or go completely down in case of low water; the extent to which it will go depends on the amount of heat it is subjected to while uncovered. 6. What is the average life of a locomotive with good usage? A.—6. From fifteen to twenty years. 7. How often should crown-bar bolts be replaced by new ones? A.—7. Crown-bar bolts generally last until it becomes necessary to remove the bars for cleaning the crown sheet, seldom failing from usage. 8. What is the tensile strength of 5-16, ⅜, 7-16, ⅝, ¾, ⅞ and 1-inch bolts? A.—8. For iron of 50,000 pounds tensile strength, the ultimate strength is 2,250, 3,350, 4,600, 10,050, 15,050, 20,950 and 27,500 pounds, respectively. 9. In case of crown-bar bolts being badly rusted, is the portion that remains, as strong in proportion—that is, does the rusting affect the metal that still remains? A.—9. There is no information extant bearing on the effect of rust on iron; we believe, however, that the net section of a bolt not affected by rust is not greatly impaired in strength.

A familiar sight in the blacksmith shop is the bent draw-bar between engine and tender in there for more bend, for such a bar will not long stay with the proper amount of set in it, since the pull on it tends to straighten it, and quickly leaves lost motion between the engine and tender chafing irons. There is no way to rectify this vexatious state of things except by making the draw castings in line, and this can often be done by bolting a new one on the deck with the pocket in the right place to get a straight draw-bar.

Sixth Annual Convention of the Traveling Engineers' Association.

TUESDAY'S SESSION.

Promptly at 9.30 A. M. the convention was called to order by President D. R. McBain in the assembly room of the Genesee Hotel, Buffalo, N. Y.

After prayer by Rev. Albertson the convention was welcomed to the city of Buffalo by Mayor Diehl.

President McBain addressed the convention, complimented it upon its progress and success, and made valuable recommendations as to economy in use of fuel and oil, also interesting and instructive remarks on draft appliances for front ends.

Secretary Thompson's report showed the good condition of the association's financial affairs to be gradually and steadily improving.

The paper on "What Is the Best Method to Be Pursued by Traveling Engineers in Giving Air-Brake Instruction While on the Road?" was read. The paper abounded in good, sensible recommendations, and was quite thoroughly discussed and commented upon by Messrs. Davis, Andrews, Turner and others.

At 12 o'clock the meeting adjourned for the day. The afternoon was pleasantly spent by the members and their ladies in visiting the many interesting places about the city, carriages being furnished by the Committee of Arrangements.

WEDNESDAY'S SESSION.

Meeting was called to order at 9.30 by President McBain, and the discussion resumed on the paper, "How Can the Traveling Engineer Best Instruct Firemen and Enginemen?"

Mr. Conger believed a more economical firing would be had by allowing the fireman to pump the engine. This was his experience.

Mr. Hancole has encouraged the fireman to pump the engine, and has found where steam is hard to get, the plan is greatly advantageous.

Mr. I. H. Brown believed it a matter of education to allow the fireman to pump the engine, under the engineer's direction, but the bad location of injectors at present would make it difficult. It would be better for all concerned.

Mr. Wallace did not believe in the scheme.

Discussion closed. Paper accepted as read.

After an intermission of ten minutes to distribute theatre tickets, Mr. Hancole read a paper on "The Better Location of Block and Semaphore Signals." He urged a good location with clear background, on tangents when practicable, and sufficiently far off to be heeded without loss of time and reduced speed.

Mr. Conger endorsed the report.

Mr. Meadows stated that his road had changed signal to agree with report, and good results had followed.

Messrs. Crane, Brown and Cass objected to red light being shown near main line, except for danger and when stop is required.

Mr. Hogan commended the block system of signalling in use on the New York Central, and gave interesting talk on fast-train running.

Superintendent Niles, of the Lake Shore, being present, was called upon for remarks, and said that although we now enjoy good signals, he believed that we are not yet out of the undeveloped state, and that better signals would yet come.

Discussion closed, and resolution adopted supporting the paper.

"The Uniformity of Cab Fittings and Their Arrangement with a View of Accessibility and Utility" was then read by Chairman C. P. Cass. It abounded in sensible recommendations, and showed up the slipshod methods of builders and shop men in "sticking up" cab fixtures regardless of their accessibility to the enginemen.

Mr. Smith criticized the neglect of builders and shop men to properly locate the injector, and cited a growing tendency to put elbows in both suction and delivery pipes.

Mr. Nellis was called upon and said that air gages were generally poorly located, but brake valves were being now more carefully placed in the cab.

Messrs. Hutchinson and Conger advised that better balanced throttles be used.

After considerable discussion on balanced throttle valves, Mr. Hutchinson drew the subject to a close by advising that a good throttle ratchet be furnished as recommended by the paper.

A considerable discussion on the advisability of connecting the lubricator to the boiler or steam turret was had, in which many members joined, and seemed to agree that if the turret pipe were sufficiently large to supply all steam cocks and maintain pressure in the turret, the lubricator could as well be attached to the turret as to the boiler.

Mr. Stack, of the Union Pacific, stated that injectors on the outside of cab gave good results. Messrs. Widgeon, Kieth and Owens favored half injector inside and half outside the cab.

Mr. Ferry said that injectors were placed so high on some engines because the boiler, being so large, crowded it there.

Discussion closed. Paper accepted.

Chairman P. H. Stack, of the Union Pacific, then read the report of the Committee on "Lubrication of Locomotives, etc.," which was quite lengthy and complete.

On motion, the discussion of the paper was postponed until the following session. Meeting adjourned.

THURSDAY'S SESSION.

The meeting was called to order at 9.30 A. M., and the discussion began on the paper, "Best Methods of Reducing Hot Bearings, etc."

Mr. C. P. Cass opened the discussion with a full and concise summary of lubrication of locomotives, and made some sensible and useful recommendations.

Mr. W. J. Walsh, of the Galena Oil Company, gave quite an instructive talk on oils, their qualities, gravities and flash tests.

Messrs. Conger, Hutchinson and Talbert discussed dry packing or wick trimming for driving boxes, eccentric straps and rod cups; but the sentiment seemed to be against the wick feeder.

Messrs Walsh and Seeley believed that the better plan to lubricate engine and engine truck journals was from the cellar, as in cars, instead of through the top of box.

The use of engine oil for back ends of main rods was discussed, and it was the general opinion of the convention that valve oil gave better results with lower cost. It was also believed that many back-end brasses ran hot because of defects in metal or fitting, rather than in the lubrication.

At 12 o'clock the meeting adjourned. The afternoon was spent by the members visiting the Depew shops and the Gould Coupler Company's works. The ladies were escorted by Mr. Bryant to Niagara Falls, *via* electric trolley car, and returned *via* New York Central. A large theatre party was formed to attend the performance of "The Little Minister" in the evening. Thus the day was fully and pleasantly filled by the agreeable mixture of business and pleasure.

FRIDAY'S SESSION.

The meeting was called to order at 9 A. M. Messrs. Conger and Davis related the trip extended to them by the Lehigh Valley on the Black Diamond Express and a return trip over the New York Central on the Empire State Express. It was very interesting.

Mr. C. B. Conger then read the paper on "The Use of Water on Hot Bearings of Engines and Tenders."

Mr. Cass believed the use of water on a hot journal to assist in cooling and getting the train in on time is a good practice, but did not wish to be understood as advocating water lubrication to the exclusion of oil.

Mr. Pitcher did not believe water and oil, simultaneously applied, could be advantageously used.

Mr. O'Neill said water on hot journals was used with good results on his road. Mr. Dallas vigorously opposed the use of water and urged an abandonment of the scheme.

Mr. Conger deemed the use of water as

a creditable expedient to cool a temporarily hot box.

For lack of sufficient data on the subject, it was carried over to next year. This ended all the subjects and their discussions.

The election of officers was as follows: President, D. R. McBain; First Vice President, P. H. Stack; Second Vice President, Chas. Davis; Third Vice President, C. P. Cass; Treasurer, C. A. Crane; Secretary, W. O. Thompson; Executive Member, J. R. Beldon.

Cincinnati was elected as meeting place for next year.

In the afternoon the members and ladies visited Niagara Falls, where proper conveyances were in waiting to carry them to the many points of interest. A most enjoyable time was spent, and in the evening the members and their ladies departed for their homes.

The Baldwin Locomotive Works.

The building of locomotives is an industry that has received a wonderful impetus in the last few months, as a visit to any of the large establishments will find good evidence. This is due not alone to the foreign orders in hand, but to a domestic demand as well, and between the two causes for increased activity there are signs of a favorable output. This was noted in some observations made at the Baldwin Locomotive Works recently, which had provided increased facilities for handling heavy orders, both in the way of force and by labor-saving devices.

Two Sellers electric traveling cranes of 100 tons capacity, in the erecting shop, are an improvement at once recognized as new, and the six Fairbanks portable scales for weighing the load on each pair of wheels is another good thing. The capacity of each scale is 50,000 pounds, and while they are equally as important an appliance in their way as the cranes, in the results they are made to give, they are not money earners in any sense, and a great many shop managers would therefore regard the scales as a luxury to be denied rather than a necessity. The cranes have already shown themselves a good investment in handling the material for export, as, for instance, packing of parts in boxes and lifting of the latter to cars for removal. They are in constant use.

In the erecting shop there are engines in various stages of completion for every part of the world, and for all kinds of service, from the consolidation to the little plantation engine of 20-inch gage, with cylinders 7 x 12, and a perfect duplicate in all essentials of the larger road engine.

To us who have grown away from the copper firebox and copper staybolt, that construction looks quite odd, but there are many queer things on these engines destined to turn their wheels in countries remote from this, and manned by strange races on the opposite side of this globe of ours.

To look at the high handrail around the running board of those engines for Russia and China, the first impression is one of clumsiness, but it is within the memory of most of us when almost every engine in this country was fenced in just the same as these, and it looks strange now because we are unused to it. Engines with a screw reverse, and others with frames outside of the wheels, also have a foreign air, and put a fellow's mental machinery in a musing mood, until the spell is broken by a sight of the four Vauclain cylinders.

The shops containing the machine tools give the greatest evidence of push, in the work stacked up waiting for a chance. This was specially noticed in the cylinder and rod departments, where the glut appeared to be concentrated. Rods are milled at the junction of the body and butt, and it is done in a way to leave no room for comment from the most savage speed crank; the mills are run with a periphery speed of 80 feet per minute—and do good work. The planers are also speeded up; those on frame work have a cutting speed of 20 feet per minute, and a return of six to one. This is lively work for a large tool, but it performs without shock. These little demonstrations of speed show a thorough understanding of the management with the details of economical tool operation.

One of the best arrangements of massing tools for special work is that in the link-motion shop, which, by the way, is on the second floor. The tools comprise the lathes, planers and drills necessary to do the work on links, lifters, tumbling shafts, rockers, etc., and besides these there are two case-hardening furnaces on the same floor and a part of the equipment, thus making it unnecessary to leave the floor for anything connected with the work of the gang. A considerable saving of time is effected in removing stock from rocker arms by a reciprocating motion, applied to the lathe on which the rocker is turned, which causes the arm to vibrate before the tool, and not make a complete cycle, thus taking off all stock in the lathe except that portion remaining under the bosses.

Some 9-inch driving axles with a 2½-inch hole through the center have just been completed, probably the first of the kind.

The holes were bored in these axles by holding one end in a steady rest and boring half-way from each end with a cannon drill, power fed by a train of gears to the tail-block spindle; a scheme devised for the job. Removal of the material from around the neutral axis of the axle is found to be advantageous, particularly in the case of wrought iron, which, when of large section, is likely to be imperfectly welded at the center.

In any event the hollow section is the strongest per unit of weight, the 9-inch hollow axle corresponding in weight to a solid one 8⅝ inches in diameter, in which the resisting moments of the two sections are 71 and 63, respectively. There are a great many interesting things to the mechanic to be seen around this plant, and a good thing about it is their willingness to impart information and exchange ideas.

The Raub Locomotive Again.

The Raub center power locomotive is one of the worst freaks that ever cranks recommended for pulling railroad trains, and we have repeatedly paid our respects to the idiotic claims made for it. The engine has four pairs of drivers coupled and the power is applied to the middle of the side rods from vertical cylinders to a supplementary axle. Every year or two this engine is boomed as something wonderful and of a revolutionary character. The booming season is on again and several daily papers have been publishing pictures of the engine and predictions that she was going soon to send all other kinds to the scrap heap. Among the merits claimed for the engine is that it has no dead weight and that waste products of combustion are used as fuel. That is an expression likely to catch the capitalists, but most railroad men know that the boomers of the engine intimate that they can burn over again the smoke-box gases that have all heat-making properties taken out of them.

The *Pittsburg Post*, referring to an article on the Raub locomotive, published by a contemporary, says:

"The story about the wonders to be performed by the Raub engine on the B. & O. as published yesterday morning in a Pittsburg paper was more wonderful than the alleged engine, in view of the fact that the engine with eight drivers without any "dead" weight is certainly a modern phenomenon worthy of being noticed. What is meant by "dead" weight in a locomotive is hard for any one having any practical knowledge of locomotives to understand, as tractive force cannot be obtained without friction between the driving wheels and the rails, and every increase in weight must have a corresponding increase in cylinder dimensions and steam pressure, and an engine which would effect a saving of 80 per cent. in fuel and weigh only 30 tons would be of no avail whatever. When an inventor talks about getting increased tractive force by reducing the weight, he is simply perforating the crown of his hat with pneumatic pressure generated by lung power and not regulated by brain. It is also stated that the new "wonder" will generate a steam pressure of 160 pounds. We wonder if the man who described it knew that the standard engine of to-day carries from 185 to 200 pounds of steam, working pressure."

The Firemen's Convention.

The firemen will long remember Toronto and the convention of 1898. Never was any body of men more cordially welcomed or made to feel more at home, and the best of feeling was exhibited by everybody.

The public reception was one of the heartiest exchange of good fellowship that we know of, and shows the good that can be accomplished by careful, conservative and yet vigorous management. This has gained for the brotherhood the respect and good will of those who are apt to look askance at brotherhoods or labor organizations, and the remarks of the Mayor and the members of Parliament showed that their work was appreciated.

The attendance was very gratifying and the good feeling between different sections of the country—and they were all represented—gave evidence of their unity of purpose.

The ladies were also well represented and it is a good sign that every meeting of all the societies shows an increase in this respect.

We trust that the new Grand Master will continue the good work of Mr. Sargeant and have no doubt that he will.

Convention Chat.

Aside from the grand officers, and a close second too, the most popular man of the convention was W. S. Carter, the editor of the B. of L. F. Magazine. He was always in demand and every member vied with the others in telling what a good magazine he was getting out.

E. M. Stannard was on deck with his new drop spring cab seat and the idea seemed to be popular with the boys who handle the big engines, where, as one man expressed it, "it takes a narrow gage man to get in the cab."

Mr. E. E. Clark, Grand Chief of the Order of Railway Conductors, told a story on Grand Master Sargeant that is too good to keep.

It was years ago when he was working 27 hours a day to build up the brotherhood and establishing new lodges all over the country. Both he and the order were short of cash and he didn't indulge in parlor cars or sleepers.

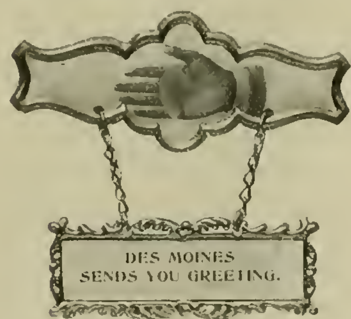
One night, however, he was dead tired and at midnight he crawled into a sleeper and went to sleep. Pretty soon he had an overwhelming desire for a drink of water, one of the "I must have it" kind, and he called out, "Porter, porter, I want a drink."

As usual no porter responded and he repeated the invitation to lubricate his interior anatomy. Finally a man opposite stuck a sleepy head out of the berth and said, "If you want a drink, why in blazes don't you ring the bell and get one."

This was news to Sargeant, but as he had to have the drink he jumped out of his berth and pulled the bell rope. Then the train stopped and the conductor rushed in to know who pulled the bell. "I did," said Sargeant; "I wanted a drink, and"—he remarked sadly—"I walked 9 miles to the next town."

Toronto is one of the most hospitable cities we ever struck, except on Sunday. It can give any place we know of points on being "tight" on Sunday, though. You can't buy a box of matches in a drug store, and can't get a shave in the hotel without an order from the clerk. We fully expected to have to get a doctor's prescription that we needed food, before getting dinner, but they have evidently overlooked that. It's a great town, though—all but the hotels.

LOCOMOTIVE ENGINEERING souvenirs were in great demand and attracted favorable attention, even the daily papers mentioning them.



There was quite a rivalry between Des Moines and Milwaukee as places for the next convention, and each had neat badges. Des Moines extended the "glad hand," as shown in the engraving, and Milwaukee's "bright spot" was a happy thought of Mr. Carmichael, secretary of the Business Men's Association of that city.

The Meriden Machine Tool Co., Meriden, Conn., which make a specialty of forming lathes for turning all kinds of articles into all kinds of forms sends out a little circular asking people if they would not like to receive one of the company's catalogues. We advise our readers to say yes. They will find it very useful and interesting.

New York Central Shops.

STANDARD BOLTS—PORTABLE FORGES—TOOL GRINDERS—BLUEPRINT CASES—PAINTING CYLINDER COVERS—TAIL RODS ON PISTONS—ALUMINUM VERSUS GOLD LEAF.

There are not very many railroad shops which lay themselves open to the charge of being clean, but the West Albany shops of the New York Central will have to plead guilty to the charge. They are about the cleanest railroad shops the writer has ever seen—which may have been partially due to its being Saturday afternoon, though even this doesn't affect some shops. White paint, whitewash and clean tools add much not only to the appearance, but also to the quality and, we believe, to the quantity of the work as well.

The stock room is a credit to any shop, and is not only neat, but a real saving of time in finding what is wanted. The bins are painted white, with the front board bearing the bolt (or other part) size in aluminum leaf on a black ground. Rod bolts, set screws, injector parts, etc., etc., are kept in this way. They are also introducing standard length bolts and set screws, and insisting on their use, which is a step in the right direction.

All lathe tools are ground in a tool room on a Sellers grinder, a feature which is too little appreciated in many shops. It not only saves the men's time in hanging around the grindstone themselves, but saves the tools and turns out more work, or ought to.

Grindstones appear to have been abolished in these shops, as emery wheels seem to be used entirely. In the erecting and boiler shops there are independent emery wheels, driven by small oscillating air engines, for sharpening chisels and similar tools, this being the only exception to the tool-room grinding scheme, and is apparently justified. Similar oscillating engines are used for driving cylinder-boring bars and valve-facing machines. They have been found more economical of air than the rotary motors in this shop.

Several portable forges were seen in the tank and boiler shop, blown by compressed air, and coupled to the shop line at any desired point by a regular air-brake hose coupling. This blows a forge fire steadily with any desired blast and doesn't go to sleep, as a rivet boy has been known to do after a night at a dance.

Tail rods on pistons are being largely used on this road now, even on small-sized engines, one for an inspection engine just being got ready for shipment. The piston, by the way, was solid, and had three ⅝ square rings let into it, no "bull," "junk" or "master" ring being used.

Different classes of repair work are kept separate in this shop, so that men may get used to their particular kind of work. Freight engines are kept separate from passenger locomotives.

Work schedule boards, as they may be called, are in each department, and the parts are worked on accordingly. If engine "961" heads the list, all departments hustle parts of this engine out before touching anything else, except where an engine is listed as "special," in which case it is given preference everywhere.

One of the attractive features of the shops is the drawing or blueprint cases in the different departments. These are simply but neatly made of walnut, with glass doors, and the prints are kept on edge so as to be readily handled. The divisions are ¼-inch iron rods, painted white, and numbered. The prints are mounted on tin with the edges turned over, and the print is varnished thoroughly, so as to be easily kept clean. In this way the prints are kept where they are needed, and can be easily referred to.

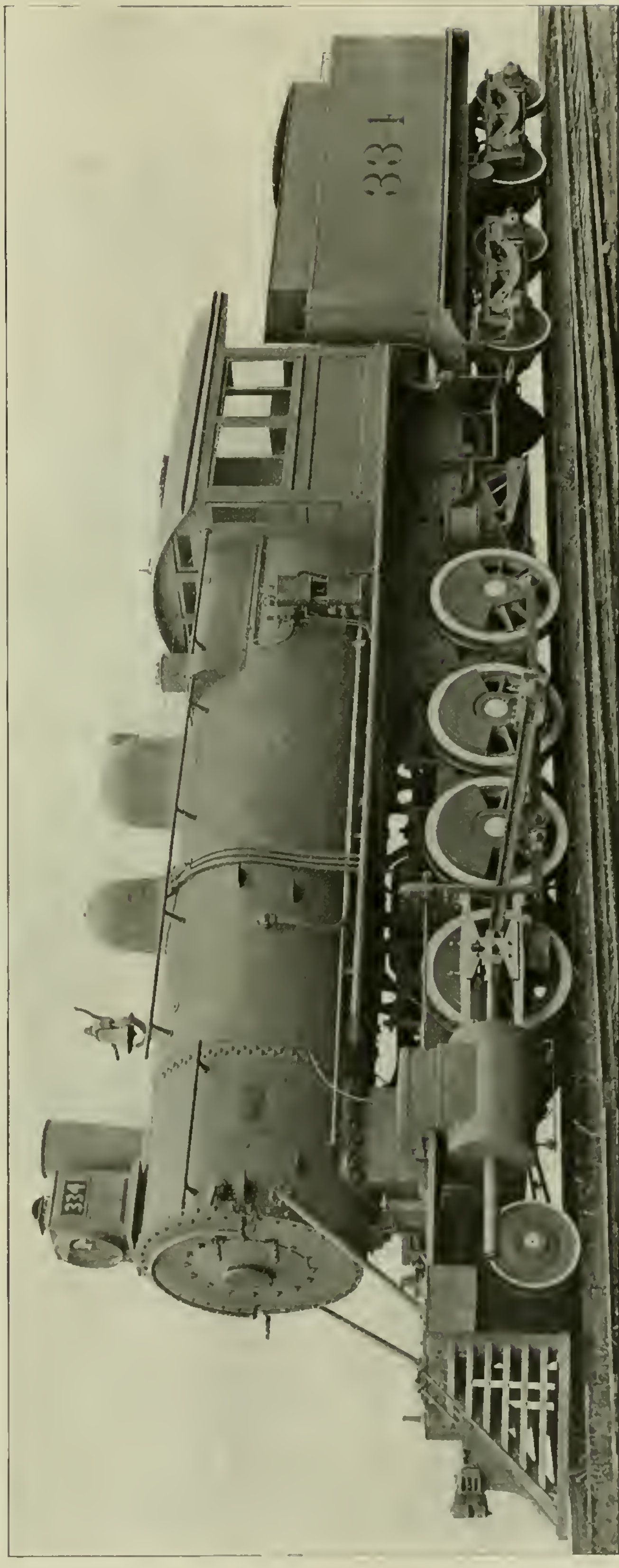
In the painting department there is a machine for cleaning and painting cylinder-head covers. It consists of seven vertical spindles, each of which carries a cylinder cover, and as they are revolved the castings can be readily worked down to a proper finish for painting, and painted also, by holding the brush while the covers revolve. This gives a nice finish, as it can be made very smooth, and the "grain," so to speak, runs concentric with the center of cover. This is driven by an air engine.

Gold leaf has been replaced by aluminum here, and this, with the improved tools that can now be had for laying it, makes it a very cheap ornamentation. For stripes, it now comes in rolls of the desired width, and with these put in the tool, it is merely a question of rolling it along, leaving the stripe behind it. General Foreman Walters knows how to make a visit interesting to a fellow mechanic.

Burlington & Missouri River Locomotive.

The remarkably handsome consolidation locomotive hereby shown is one of an order placed by the Burlington & Missouri River Railroad people with the Pittsburg Locomotive Works. The engine is a remarkably powerful machine and shows phases of much careful and skillful designing.

The cylinders are 22 x 28 inches, and the driving wheels 52 inches outside of tires. The working pressure is 180 pounds per square inch, and with the dimension of cylinder and driving wheels mentioned give a tractive force of about 40,000 pounds. The coefficient of adhesion is 4.1. Weight of the engine in working order is 180,000 pounds, of which 166,000 pounds rest on the drivers. The driving wheel base of the engine is 15 feet, and the total wheel-base 23 feet 6 inches. Richardson balanced valves are used, and the pistons are all cast steel, with Dunbar packing.



PITTSBURGH, BURLINOTON AND MISSOURI RIVER RAILROAD ENGINE.

The boiler is 74 inches diameter at the smallest end, and contains 292 tubes, 2¼ inches diameter. The firebox is 114 inches long and 40 inches wide. The grate area is 31.67 square feet. The tubes provide 2,486.4 and the firebox 188.6 square feet, making a total heating surface of 2,675 square feet. The journals of the driving axles are 9 x 10 inches; those of the truck axles 5½ x 9 inches. The engine is equipped with Westinghouse air brake and the American driver brake.

Work at Purdue University.

Purdue University entered upon the work of a new term on the 14th inst., under conditions favorable to an excellent year's work. The engineering laboratory, so well known to engineers the country over, has, during the summer, been supplemented by the addition of a room 50 x 100 feet, known as the Railroad Laboratory. In this room the equipment of machines for testing strength of materials, and the brake-shoe testing machine of the Master Car Builders' Association are already in place. There is also a fine full-sized model of the front end of a Richmond compound locomotive, and an exhibit of typical steel car trucks. The equipment of this room will be completed during the fall by the installation of the air-brake testing rack of the Master Car Builders' Association.

The number of students matriculating for the new year is larger than for several years past. The Freshman class will number about two hundred, nearly two-thirds of whom are in the engineering courses.

There are but few changes in the corps of instructors in the engineering department. Mr. Leopold O. Danse, for several years senior instructor in Mechanical Engineering, Lehigh University, has been appointed an instructor in Machine Design, and Mr. Robert S. Miller, assistant in the Engineering Laboratory, has been made instructor in the Mechanics of Machinery.

Some Running.

They do some very fast running on the London & Northwestern road in England. The summer time-card has two trains scheduled between London and Liverpool, 201 miles, at an average speed of 51.8 miles per hour; five trains between London and Crewe, a distance of 158 miles, at 51.6 miles per hour; two trains between Carlisle and Crewe, 141 miles, at 52.9 miles per hour; two trains between Wigan and Carlisle at 52.6 miles, and two trains between Willesden and Sheffield at 52.2 miles per hour.

Someone has seized on the idea of the cinder car, with its sloping floor and side discharge, to perfect a car for coal transportation. The sides are hinged at the bottom, and when down form a continuation of the inclined floor outward from the side of the car.

As if to atone for an enforced inactivity during the heated term, the coupler man has worked through the Patent Office what is easily the biggest freak for a coupler yet invented. It does not belong to the tribe of any coupler yet produced, but comes nearer the link and pin than anything else. The draw-head is something like the old bell-mouthed affair, from which protrudes a bar looking much like a whale harpoon, and has barbs on the side of it. This bar is pivoted somewhere in the draw-head mouth. All the parts for manipulating the device are situated on the roof of the car, but levers are conveniently arranged from the roof so as to be reached from the ground. It seems too bad that a government can be so heartless as to take our yeoman's gold for such useless devices as this.

The Bartow bell-ringer, which we illustrated in our June issue, on page 317, is now being put on the market by the Chicago Pneumatic Tool Company. They are constantly increasing their line of specialties, and seem to have a happy faculty of selecting good ones.

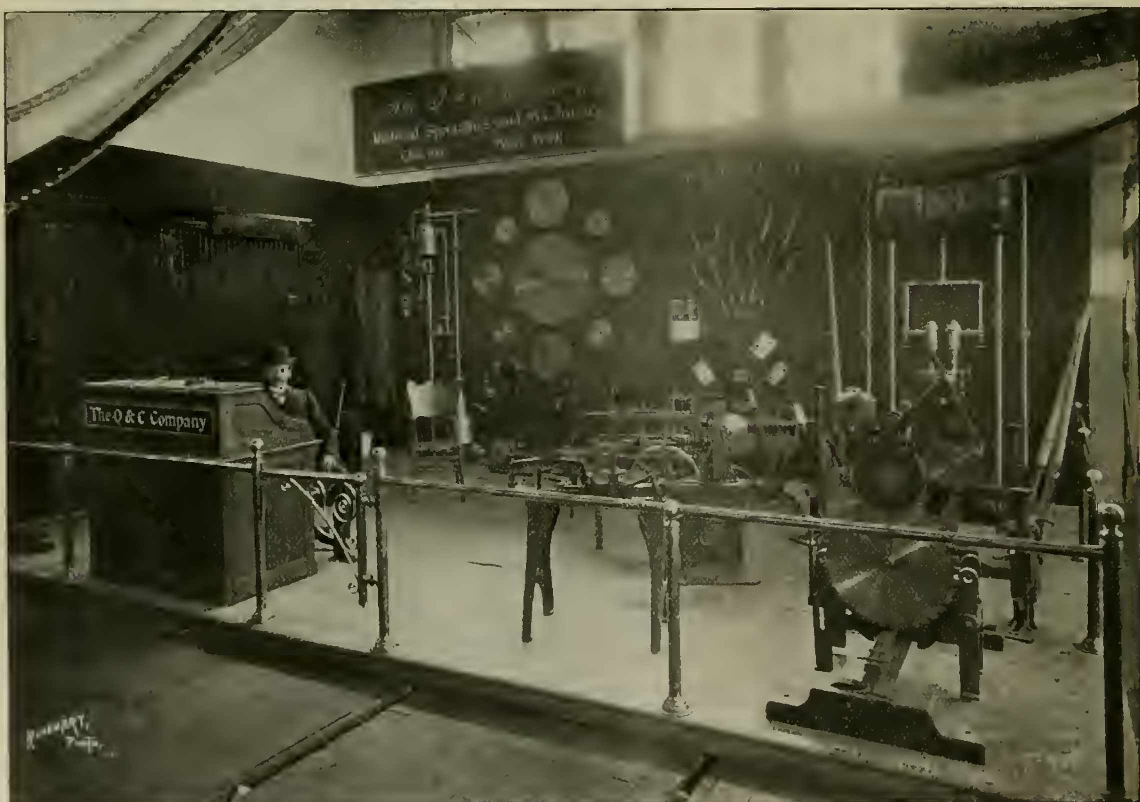


EXHIBIT OF Q. & C. CO. AT THE OMAHA EXPOSITION.

Keeping Up Appearances.

Once in a while a car porter gets off a good story. One regaled us the other night while making up "lower 6" with a tale of one of his "frens" who left home and came back "busted," but he came to town in style.

He only had 50 cents left and had hoofed it all the way to the next station below his native town and there he donned his shoes, brushed up a little and came home as large as life and 15 cents in his pocket. This may be a suggestion to some of our friends who had the Klondike fever.

Armstrong Bros.' New Cutting-Off Tool.

We illustrate below a new cutting-off tool which is being placed upon the market by Armstrong Bros. Tool Company, of 106 and 108 West Washington street, Chicago, Ill., well known to the mechanical trades as makers of an extensive line of tool holders for metal working. This tool is based upon the same mechanical principles which have attracted favorable attention to the Armstrong tool-holders, viz., an inserted cutting blade of self-hardening steel, supported by a permanent holder of drop-forged steel. The blades are beveled on both sides, thus insuring the proper amount of clearance necessary for a clean-cutting tool. They require grinding on the cutting end only. The bolts and holder are hardened, and will stand constant use for years. The cutting-off tools will be made in seven sizes, suitable for all classes of work.

ARMSTRONG BROS.' NEW CUTTING-OFF TOOL.

Proposal to put Cow Catchers on British Locomotives.

Owing to a fatal accident which happened last month to an express train on the Midland Railway of England, there arose considerable talk in favor of equipping all British locomotives with cow-catchers. Some boys were amusing themselves with a baggage truck on the platform of a roadside station, and they pushed it upon the track just as an express train was approaching. The station, like many others in the British Isles, was on a curve. When the engine struck the truck, fragments of the wood and iron were caught by the leading wheel on the outside of the curve, and it naturally jumped the rail. Six persons lost their lives by the accident.

At the coroner's inquest a statement was made that the accident could not have happened had the engine been equipped with the cow-catcher used on American locomotives, and the daily papers used the absence of cow-catchers on British locomotives as a text for leading articles abusing railway companies—the soulless corporation plaint.

We do not think that any of the railway companies concerned are arranging to put pilots upon their locomotives, and the agitation only serves to show how senseless popular agitations often are when safety appliances are under discussion. If the locomotive that figured in the disaster had been provided with a pilot, it is doubtful if the derailment would have been avoided, as the platform would have prevented the pilot from throwing aside the obstruction. Then the British track does not lend itself to the safe use of a pilot. The rails are set up on cast-iron chairs and the ballast is kept down almost to the level of the ties, so that there is a deep space which the pilot could not touch. In America it is well known that a high pilot is dangerous, and a pilot on British locomotives would always be high. Those who examine this question free from prejudice, bias or the need for a subject to hang a grievance upon, will readily agree that the British practice of securing a strong iron bar in front of each leading wheel is the safest plan that could be adopted.

The Pennsylvania Road has made some interesting experiments to find the duration of life of telegraph poles, by erecting a number of them on the line, in which different woods and methods of setting—the factors upon which information is wanted—will be of such a varying character as to suggest some valuable data for future reference. The setting of these poles comprise the old method of an ordinary hole with the earth tamped around the pole, besides a setting in broken stone, and a setting in a drained passage in which oil has access to the imbedded end of the pole.

The long evenings are now upon us and reading matter is in demand. Those who are inclined to join improvement with pleasure should send for our "Book of Books." It is sent free on request.

Old-Time Railroad Reminiscences.

BY S. J. KIDDER.

A few persons are born lucky and the balance seem to be afflicted with a quixotic belief that an old, cast off horse shoe is prognostic of good luck. There are lots and lots of people who do not give a thought over which shoulder they first observe the new moon; are utterly oblivious to the signs of the zodiac; would not give a moment's consideration as to what month they were born or draw the line at beginning a new work on Friday, but when it comes to horse shoes they would go far out of their way to pick up an ancient one, particularly if by any manner of hocus pocus the proper number of bent nails has been left in it with which to clinch the luck.

From my earliest recollection I was so imbued with the truth of the good fortune sure to follow the finding of this talismanic emblem that I grew up firm in the belief of its luck promoting qualities, though more mature reflection failed to suggest to me what there was about a badly worn horse shoe, that had, perchance, outlived its usefulness in its legitimate sphere, to promote good fortune, and finally I was brought to the stern reality that the proverbial equine sandal was a delusive snare, fatally lacking the elements which blind wisdom so very generously reposes in it, and my reasons therefor will be found duly recorded below:

My fireman was a very bright young fellow, but he had, unfortunately, gone wrong on this subject, and when, as we came into Burlington one evening, he saw a freshly laid shoe beside the track he possessed himself of it at the imminent risk of wrecking his anatomy in jumping from the 245 as it passed a street crossing at a speed not conducive to safety in alighting from a gangway.

Several days passed and the incident had been quite forgotten when one morning upon going to the roundhouse preparatory to starting out on my run, as I stepped into the cab there was that horse shoe nicely finished up and polished occupying a prominent position above the boiler head. I rather admired its ornamental appearance, little realizing at that moment, however, what a world of trouble and vexation was shortly to result from—but I must not anticipate. We got out of the house, backed down to the station and a few minutes later pulled out for our run.

We had scarcely gone more than a mile up the grade, which began rising almost at the station, when a pile bridge spanning Hawk Eye creek was discovered ahead to be on fire, the flames soaring several feet into the air. I shut off, applied the brakes and stopped near the end of the bridge. Dismounting and running on to the bridge I found the blaze just fairly getting under way, sufficient headway not having been made to weaken the structure. Quickly returning to the engine I cut off from the train, jumped aboard and run her through the fire, over the bridge, then backing down to a working distance a liberal quantity of water dashed over the rear of the tender soon subdued the flames.

Again we coupled up and resumed our journey. Middletown was some nine miles away, and a meeting point, and here we were to take the siding. This side track was entered through a quite sharp reverse curve and being on a grade was a difficult place to start a train, particularly if freight cars happened to be standing near the end, which proved to be the case in this instance.

I pulled up, coupled into the box cars and when I opened the throttle the engine seemingly gave a slight slip of the wheels and refused to move. I reversed to get the slack but again she was powerless and just at this moment the fireman exclaimed —— —— (?). "Look at this side rod." I looked and that rod was describing an outward arc as beautiful as could be imagined, and the crankpins on the drivers were twenty-four inches nearer each other than the original drawings of the engine called for.

The mischief had been started by the breaking of the back crankpin close up to the hub on my side, which, when I opened the throttle had permitted the forward drivers to revolve a half turn.

A freight engine bound in the same direction as ourselves relieved us of the train and we then proceeded to make a closer inspection. One of the main rods was bent and the crank was broken entirely from the front wheel. We disconnected, removed the broken parts, loaded up the wreckage and wended our way back to the hospital for indigent engines.

The 245 was in the back shop several weeks, during which time my fireman and myself were attached to the extra list, no one laying off, however, during the time, and that horse shoe, as you have seen, caused all this loss to the company as well as time to ourselves. I might remark right here that during the eight years I run that engine the short trip made on the morning in question was the only one against which a break-down can be recorded.

When the engine was again ready for service the place that had so briefly known that horse shoe knew it no more. The fireman often wondered what became of it, and the cab and unlocked boxes of every engine on the division were stealthily overhauled by him in an endeavor to locate that shoe, but without tangible results, and finally the quest was given up. What became of that horse shoe?

Well, gentle reader, I don't mind telling you that that shoe was surreptitiously removed from the cab on the day of the accident, and lo! these many years has silently reposed, the writer has the very best of reasons for knowing, beneath the dark and murky waters of the Mississippi river.

Chicago, Ill.

Metal Sheathing of Coaches.

There was not anything in the mechanical line that excited more interest among the masters in attendance at the Saratoga conventions than the copper-sheathed passenger coach of the New York, New Haven & Hartford Railroad. The full-sized section, taking in the sheathing from the sill to the letter board and roof, showed the application of the copper sheets and how they were secured by invisible nailing, so clearly, that inquiry as to details was superfluous.

Unlike a great many experiments, this one has stood the test of service so well as to bear out the predictions made for it nearly two years ago, and the successful outcome has impelled Master Car Builder Appleyard to investigate the cost and wearing qualities of other sheet metals, notably aluminum and also aluminum bronze.

If it is a fact that the cost of sheathing a coach with copper is not materially greater than that of the work done in the paint shop, there are some possibilities of a substantial cut in expenses, and that, too, in a direction that gives about the least return for the money invested of any of the many drains on railroad earnings.

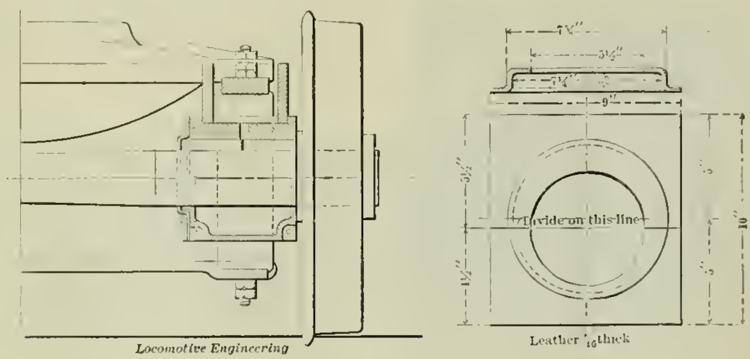
Pullman's First Ride in a Sleeper.

Shortly after the sleeping cars were introduced on the Lake Shore Railway, George M. Pullman, who was brought up in New York State, determined to go West. He concluded to indulge in the luxury of a sleeping-car berth, and was assigned to the top part of a section. He lay there trying to hold on, until he was worn out, then he got down and spent the rest of the night sitting on the wood box.

During the vigils of that weary ride he concluded that radical improvements were needed in sleeping cars to make them what they ought to be. Although not reared in the lap of luxury, Mr. Pullman had extremely luxurious tastes. When he devoted himself to the building of sleeping cars, his consuming desire was to make something better than anything that had been produced before, and his whole career was dominated by that sentiment. The first two sleeping cars which he made, by changing two day cars belonging to the Chicago & Alton Railroad, were models of comfort compared with anything previously put into service.

The first car which he had built as a sleeping car was a marvel of luxury, convenience and comfort, and is not much behind any of the most modern sleeping cars. He raised the roof of the car to make room for a comfortable upper berth, and widened the car so that the station platforms had to be cut off to let it pass.

How he succeeded in prevailing on railroad companies to do this is one of the mysteries of railroad history. It is said that Mr. Pullman spent $300,000 on experiment before he produced a satisfactory upper berth.—Angus Sinclair, in July *Pall Mall Magazine.*



UNION PACIFIC DUST GUARD.

Union Pacific Dust Guard.

This is one of the small details of railroading which appears trivial at first glance, but which is in reality very important when it comes to life of bearings and consumption of lubricants.

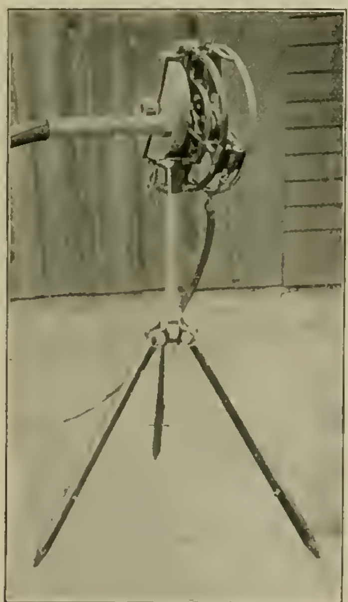
The dust guard shown is made of tough leather, 3-16 of an inch thick and is pressed into shape by hydraulic press in a similar manner as hydraulic piston packing. The details are shown quite plainly on the truck axle, and are, of course, similar for the driver axle. The fact that they have given great satisfaction on the Union Pacific Railroad, and that they seem to have a wonderful endurance, shows that they are accomplishing their object.

The Sargent Company's open hearth steel plant has been running for the past few months at its fullest capacity on several large contracts, among which may be mentioned the castings for 10-inch gun carriages for the United States Government. The Sargent Company has been very successful in this class of work, readily meeting the physical tests prescribed by the Government, as well as the short delivery which is demanded in most cases. The good record that they have been making is taken as an indication that they will obtain their full quota of this class of work in the awarding of future contracts.

Williams Air Motor.

The engraving shows a neat portable air motor in use at the Corning shops of the Fall Brook Railroad, which was devised by Mr. Williams, the foreman of the shops.

It is mounted on a tripod, and the air



WILLIAMS AIR MOTOR.

inlet is through the small hose at bottom. There are three small cylinders set at 120 degrees and getting air from the ring of pipe shown. The gearing is contained in the case at the left, from which the flexible shaft is driven. It is a very handy device, as it can be taken to any part of the shop and used where wanted.

After much experimental work on electric lighting, the New York Central is again adding to its Pintsch light. Over 500 coaches are already illuminated with Pintsch gas, and it will only be a short time when the entire passenger train equipment will be so lighted, if the present rate of application is continued.

The Chicago & Northwestern Railway send us a neatly printed pamphlet, entitled the "Northwestern Limited," illustrating and briefly describing their train by that name. The train is electrically lighted throughout, and the pictures give a good idea of modern train service.

The Safety Appliance Company, Wentworth Building, Boston, have issued a neat catalog of their railroad specialties. They are making the devices formerly made by the Graham Equipment Company, and which seem to be meeting with favor.

The Bethlehem Iron Co., South Bethlehem, Penn., has been asked to bid on the forgings for the engine and shafting of a torpedo boat to be built in Japan for the Imperial Japanese Navy. The line of shafts, including the thrust and crank shaft, are to be hollow. It may be remarked that the Bethlehem Iron Company is the only concern in this country that has been asked to bid on this work.

The Grand Trunk Railway have some cars with rather peculiar seats—from our point of view. They look about like a clam shell opened wide and hold two people very comfortably. They seem to fit into the small of your back very nicely and relieve that tired feeling.

The Buffalo Forge Co., Buffalo, N. Y., report a number of sales, among the most recent being an outfit for the Sayles Bleacheries, Saylesville, R. I., and a complete heating and ventilating outfit for the Fashion Knitting Mills, Arcade, N. Y. They have also received a commission to build the induced draft apparatus for the power plant of the Howland Paper Co., Sandy Hill, N. Y., involving the use of two large steel plate steam fans with engines direct connected to the fans which are equipped with water cooling bearings.

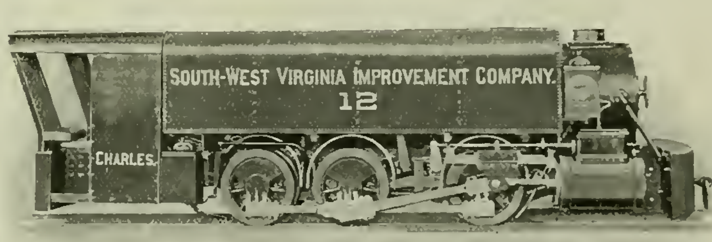
A large consignment of cars of 3 feet 4 inch gage is being made for South America, by the Lima Locomotive and Machine Company. The shipment embraces stock, box, flat and baggage cars, which are dismembered and boxed so as to facilitate transportation on mule back to destination after the rail terminus is reached. This style of getting equipment to its home road, tells a story of undeveloped country, and the need of cars going there to take the place of the pack mule. Yet there are many such places still to be reached by the sure footed hybrid before his occupation is gone.

The Newton Machine Tool Works have shipped the General Electric Co. at Schenectady one of the largest slab milling machines that has ever been completed, having a range to admit work 72 inches wide and 6 feet in hight; weighing about 50,000 lbs. They are also making a speciality of late of heavy portable tools, which the construction of electric and modern high speed crane has allowed shops to use which could not be considered, but for the universal use of electricity in machine shops. Many of these electric tools weigh between 15,000 and 25,000 lbs., consisting of portable slotting machines, boring machines, drilling and milling machines. This company have also just increased greatly their capacity for placing large tools and an additional electric traveling crane for handling the erection of light machine tools.

A Powerful Mine Locomotive.

Although built within the close limits of 6 feet 2 inches in both hight and width, and for a 3-foot gage, this is a very powerful little locomotive, as the dimensions will show.

The cylinders are 13 by 16 inches, and considering that the boiler pressure is 180 pounds, while the drivers are but 29 inches in diameter, the drawbar pull is large for this size engine. The journals are 6 by 7 inches; the wheel-base 7 feet 3 inches; tank capacity 790 gallons, and weight in working order 58,000 pounds.



A POWERFUL MINE LOCOMOTIVE.

Mr. R. Atkinson, mechanical superintendent of the Canadian Pacific, writes us: "Referring to article in your September issue, page 428, on a rotary shearing machine in use in these shops. It was found necessary when required to cut steel stock up to 1⅛ inches to increase the weight of fly-wheel by shrinking on a heavy wrought iron band about 4 inches square. The band was not turned but put on rough."

The Dixon Crucible Company of Jersey City, N. Y., has published a little pamphlet. It treats incidentally of brazing graphite, the application of which to bicycle tubes prevents the adherence of the spelter and so effects a saving in labor by making unnecessary the filing which is otherwise needful. The pamphlet, however, especially treats of the process of brazing by the dipping method, or "liquid brazing," as it is called. The brazing crucible is described, together with instruction and caution in regard to its use. Instructions are given how to build and set the necessary furnace, time required for brazing, etc., etc.

An illustrated booklet has recently been published by Mr. George H. Daniels, general passenger agent of the New York Central, which contains some novel features. It illustrates the Lake Shore Limited by means of a variety of fine half tone engravings, and it gives the passengers on the train information concerning all the leading places passed en route. We have never known of a case where this was done, but we are certain it is going to add greatly to the pleasure of people who ride from New York to Chicago on this magnificent train.

The metallic sheathed passenger-train car is to have a chance to show its virtues on the Fitchburg. There is no better opening by which to demonstrate the resistance of copper sheathing against the ruinous effects of cinders and gases, than that afforded by the long Hoosac tunnel, and there is no doubt that the cars will come out of the test with the same favorable results shown on the New Haven road. Mr. Appleyard has shown the way to extend the life of the exterior finish of a coach at a merely nominal cost, as compared with brush methods, and its general adoption cannot be deferred for long on roads having an understanding of its merits.

The Diamond Machine Company, of Providence, R. I., in addition to their large line of grinding machinery, make a great many special machines both from their own designs and from drawings of customers. They made the machines on which the now well-known "Christy" bread knives were ground automatically, and have just finished a machine for grinding a new patented bread knife on a somewhat different principle from the "Christy."

Two six-wheel connected engines are under way at the Baldwin Locomotive Works for the Baltimore & Ohio Southwestern.

The Pittsburg Locomotive Works are building one six-wheel connected engine for the Detroit & Mackinac, and one of similar type for the Centralia & Chester.

Don't laugh at the man who claims he can save only 5 per cent. of expense. You are more apt to realize his claims than those which guarantee 50 per cent.

Every man can increase his stock of practical knowledge by close observation in his daily work. It means more than most men imagine.

The increase in capacity of locomotive tanks is one of the remarkable points in new power. Only a few years ago a 2,800-gallon tank was considered a large affair, but that figure paled before those of 3,500 capacity, and this in turn gave the palm to those built for 4,000 gallons. The new engines on the Great Northern have tenders that carry 4,500 gallons, and the Chicago Great Western has 5,000-gallon tanks on their new moguls. The Chicago, Burlington & Quincy also have some new Consolidation engines with tenders of 5,000 gallons capacity. These heavy tenders weigh, when loaded, very near 100,000 pounds, or about the weight of the average mogul engine, and are therefore no mean load in themselves.

The Peerless Rubber Company, of 16 Warren street, New York, are sending, on request, a lithograph advertisement, showing the "Oregon" and giving some of her dimensions and performances. All her joints were fitted with packing and gaskets of this company, and they are naturally proud of the fact.

The Chicago Pneumatic Tool Co. write: "We have just received the second order from the Imperial Chinese Railway, and our president, Mr. J. W. Duntley, is now in New York, closing an order for Japan, for 36 pneumatic tools and 3 compressors. Our mail to-day covers also many home orders, including the United States Navy Yard, and the outlook for business is very bright indeed."

No. 6 of the "Record of Recent Construction," issued by the Baldwin Locomotive Works, contains several interesting locomotives. Ten-wheelers seem to predominate, but there is quite a variety, including several that are decidedly out of the usual; one being a rack locomotive for Brazil, and another a powerful mine locomotive with 29-inch drivers.

Mr. S. N. Fleming, a locomotive engineer at Hopkinsville, Ky., has patented an electric train-blocking system of rather peculiar character. He proposes having all locomotives equipped with a magnetic bell, electric battery and two trolleys, which make contact with a third rail. One merit claimed for this system is that the locomotive engineers miles apart can signal to each other. We are not aware that it has been applied to any locomotive.

The water scoop on tenders has been abandoned on the Maine Central, and the "Flying Yankee" now gets its liquid sustenance from the ordinary plebeian stand pipe at stations, just the same as other trains. We are not informed as to the causes leading up to this reactionary move, but the probabilities are that the old method of taking water has some advantages not realized in the track tanks.

Baltimore & Ohio engine No. 99, which has just been laid aside at Grafton, W. Va., and will be consigned to the scrap pile, has quite a history. It is one of the Ross Winans camel engines and was built in 1851. There are only four of this class of engines now remaining. During the late war this engine was one of several captured at Martinsburg by the confederates, and hauled across the country by pike to Staunton, Va., under direction of Col. Thomas R. Sharp. President John W. Garrett, after the war was over, hunted up Col. Sharp and appointed him master of transportation, in recognition of the ability displayed in that unparalleled achievement.

Advance figures from the tenth statistical report of the Interstate Commerce Commission, place the total number of casualties to persons on account of railway accidents for the year ending June 30, 1897, at 43,168. Of these casualties, 6,437 were fatal, and 36,731 were injuries of differing degree. One thousand six hundred and ninety-three railway employés were killed and 27,667 were hurt during this time. The ratio of fatalities of employés was 1 to 486, and the ratio of injured employés was 1 to 30. One passenger was killed for 2,204,708 carried, and one was injured for every 175,115 carried.

An automatic fire extinguisher for passenger coaches has been gotten up which is operated from the air system of the train, and is made so as to extinguish fire in the heater and lamps in the car at the same time, in the event of accident. The automatic features of this device consist of a weighted lever which, on falling, permits compressed air to pass into a small cylinder and actuate a piston having connection with a valve controlling the quenching fluid.

LOCOMOTIVE ENGINEERING
A PRACTICAL JOURNAL of RAILWAY MOTIVE POWER AND ROLLING STOCK

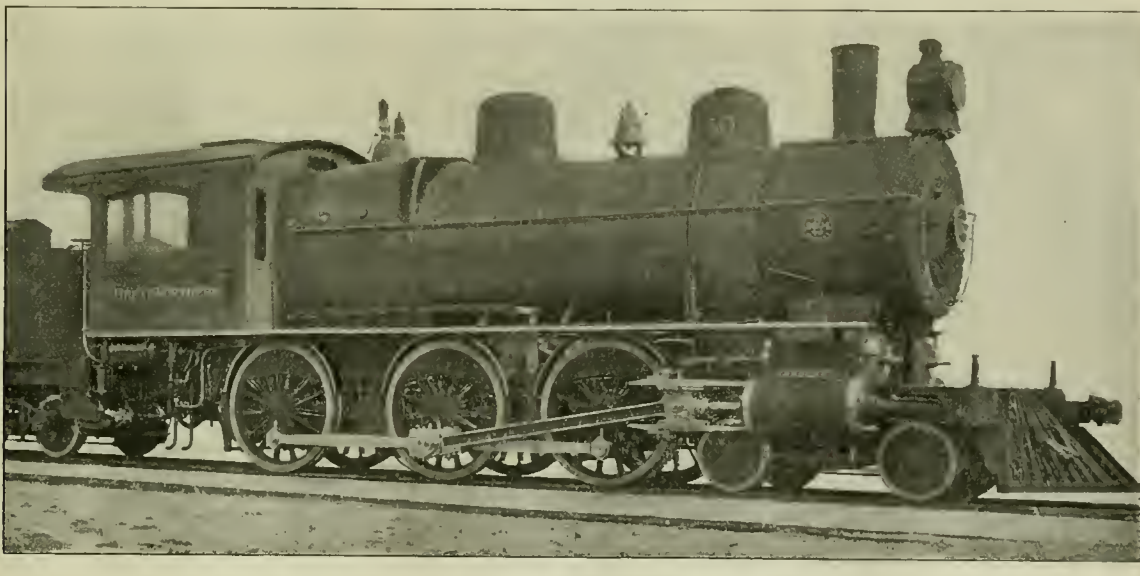
Vol. XI. NEW YORK, NOVEMBER, 1898. No. 11.

Ten-Wheel Passenger Engines—Great Northern Railway.

Our illustrations of the Great Northern's eight new locomotives show what are believed to be the heaviest passenger engines in the world. These machines were designed and built by the Brooks Locomotive Works in accordance with the ideas of Mr. James J. Hill, president of the Great Northern lines, and though keeping well within the standard practice of the builders in respect of high-class work, there are to be noted many points of difference in detail from other engines of the same type.

These engines are similar in some respects to those of the Wisconsin Central, illustrated in our June issue; but while the latter engines weighed 150,000 pounds and had a maximum draw-bar pull of 30,000 pounds, these new leviathans weigh 166,000 pounds and can exert 36,000 pounds at the rail. The coefficient of adhesion for the maximum tractive effort is about 3.6, and reaches about 4 when cutting off at two-thirds of the stroke, with a mean effective pressure of 170 pounds and 32,500 tractive power. The cylinder arrangement and piston valves, together with the spring rigging, are similar to those of the Wisconsin Central engines referred to.

The indicator cards from these engines, taken in both freight and passenger service, show in a most interesting and conclusive way the distribution and work done. The water used per indicated horsepower per hour, as gathered from the test records, is 24 pounds for passenger service and 22.4 pounds for freight.



BROOKS TEN-WHEELER FOR GREAT NORTHERN.

Steel has entered largely in the construction of these engines, embracing the driving wheel centers, driving boxes, spring saddles, crossheads, pistons, expansion pad brackets, engine draw casting and many smaller parts, which are of open hearth cast steel. A reference to the subjoined dimensions will furnish all necessary information:

GENERAL DIMENSIONS

Weight on drivers—129,500 pounds.

Weight on trucks—36,500 pounds.

Weight, total—166,000 pounds.

Wheel-base, total, of engine—25 feet 4 inches.

Wheel-base, driving—14 feet 6 inches.

Length over all, engine—40 feet 1⅜ inches.

Heating surface, firebox and arch pipes —225 square feet.

Heating surface, tubes—2,452 square feet.

Heating surface, total—2,677 square feet.

Grate area—35.4 square feet.

Drivers, diameter—63 inches.

Drivers, material of centers—Cast steel.

Truck wheels, diameter—30 inches.

Journals, driving axle, main, front and back—9 x 11 inches.

Journals, truck—5½ x 12 inches.

Main crank pin, size—6¼ x 6 inches.

Cylinders—20 x 30.

Piston rod, diameter—4 inches.

Main rod, length center to center—120½ inches.

Steam ports, length—18 inches.

Steam ports, width—2 inches.

Exhaust ports, length—56 inches.

Exhaust ports, least area—66.5 square inches.

Bridge, width—2½ inches.

Valves, kind of—Improved piston.

Valves, greatest travel—7 inches.

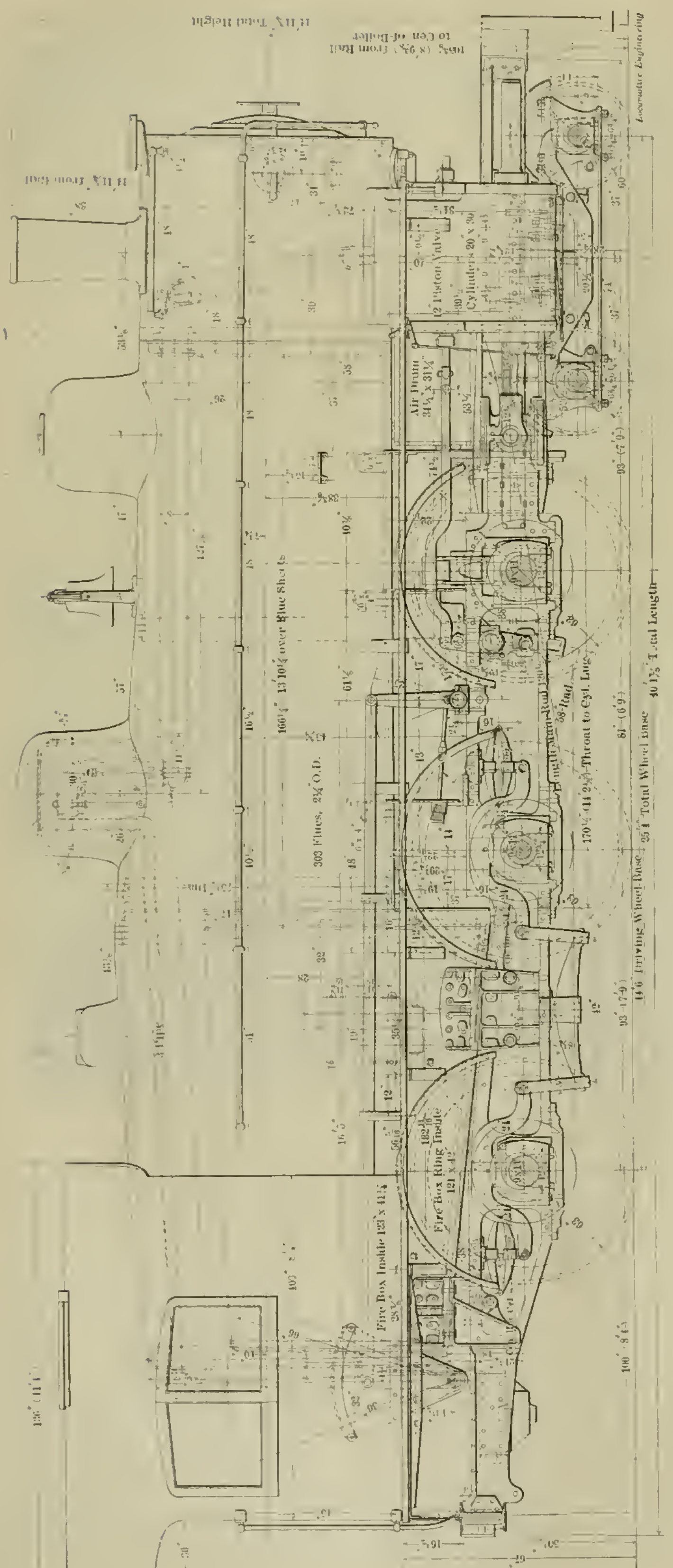
Valves, steam lap (inside)—1⅛ inches.

Valves, exhaust lap or clearance (outside)—⅛ inch.

Lead in full gear—1-16 inch negative.

Boiler, type of—Player improved Belpaire.

Boiler, material in barrel—Steel.



BROOKS TEN-WHEELER FOR GREAT NORTHERN.

Boiler, working steam pressure—210 pounds.

Boiler, thickness of material in barrel—11-16 inch.

Boiler, thickness of tube sheet—¾ inch.

Boiler, diameter of barrel—70 inches.

Seams, kind of horizontal—Sextuple.

Seams, kind of circumferential—Double and triple.

Crown sheet, stayed with—Direct stays.

Dome, diameter—30 inches.

Firebox, length—123 inches.

Firebox, width—41¼ inches.

Firebox, depth front—80 inches.

Firebox, depth back—62 inches.

Firebox, material—Steel.

Firebox, thickness of sheets—Crown, ⅜ inch; tube, ⅝ inch; side and back, ⅜ inch.

Firebox, brick arch—On water tubes.

Grates, kind of—Cast iron, rocking.

Tubes, number of—303.

Tubes, material—Charcoal iron.

Tubes, outside diameter—2¼ inches.

Tubes, thickness—No. 11 B. W. G.

Tubes, length over tube sheets—13 feet 10¼ inches.

Exhaust nozzle—Single.

Exhaust nozzle, diameter—5 inches, 5 3-16 inches, 5⅜ inches.

Stack, least diameter—15⅞ inches.

TENDER.

Tank, capacity for water—4,500 gallons.

Capacity for coal—8 tons.

Type of under frame—Steel channel.

Diameter and length of journals—4¼ x 8 inches.

Sight-feed lubricators—Nathan.

Safety valves—Crosby.

Injectors—New Nathan No. 10 and Monitor No. 10.

Springs—French.

Metallic packing—Jerome.

Bushing of locomotive cylinders is reduced to a science on the Baltimore & Ohio. It affords a good means to hold cylinders to size, and also allows any desired degree of hardness for wear at a low cost as compared with complete renewals of the whole cylinder. The cylinder is shrunk on the bush in all cases, by first warming the former by means of a light fire in the barrel, this method having been found preferable to either gasoline or steam for expanding the cylinder.

The Newton Machine Tool Works have just received the contract from John Brown, of Sheffield, England, who is the largest manufacturer of armor plate in the world, for a special double radial drilling machine for drilling armor plate. They are also completing the drawings of a large cold saw cutting-off machine for the Armor Plate Works at Creusot, France. Mr. Charles C. Newton, of this company, has just returned from abroad, where he went on the special invitation of these firms, having in view the securing of an order for these machines.

Three-Cylinder Locomotives.

There are a good many three-cylinder locomotives in use to-day in different parts of the world, but they are a disappointment to their friends. The extra cylinder puts nearly a third of extra mechanism upon the engine without bringing any advantages to speak of.

American mechanics were early in the field with three-cylinder locomotives. The "Washington" and "Ohio," three-cylinder engines, were rebuilt at Wilmington shops by Louis Fleicker some time about 1850. The "Washington" was a 30-ton engine, carried 90 pounds steam pressure, had two outside cylinders 13½ x 20 inches and one middle cylinder 16 x 20 inches, 20-inch stroke and a 5-foot wheel without the tire.

The "Ohio" was a 35-ton engine, carried 95 pounds steam pressure, had two outside cylinders 13 x 20 inches and one middle cylinder 16 x 20 inches, 20-inch stroke and a 5-foot wheel without tire.

They were both wood-burning engines. Mr. Fleicker was master mechanic of the Wilmington shop and the designer of this style of engine. Previous to this time they were "Norris" engines.

An American Locomotive for England.

The Baldwin Locomotive Works recently built a narrow-gage engine for an English road, and the "Trade Journals' Review," of London, comments on the attempt to "carry coal (burners) to Newcastle," under the above caption, as follows:

"It is not easy to imagine the feelings with which British engineers will regard the new locomotive that has just been built in America, and will soon make its appearance in England for service on the Lynton & Barnstaple Railway. This small passenger engine, constructed by the Baldwin Locomotive Company, Philadelphia, is the first that has ever come over to the United Kingdom, although the same makers have furnished several for the British colonies.

"It is true that it is an exceptional production, built for a light railway (23½-inch gage), and it might not be difficult to assign a reason for its having been obtained from the United States. British locomotive builders are at present so full of orders for standard engines, that in all probability there are none that would care to go out of their way to undertake so insignificant a contract. The engine has no tender, it carries its own water and fuel, and generally conforms to the well-known American practice, even so far as to be fitted with the inevitable cow-catcher. This latter, however, for a narrow-gage railway, may not be altogether out of place.

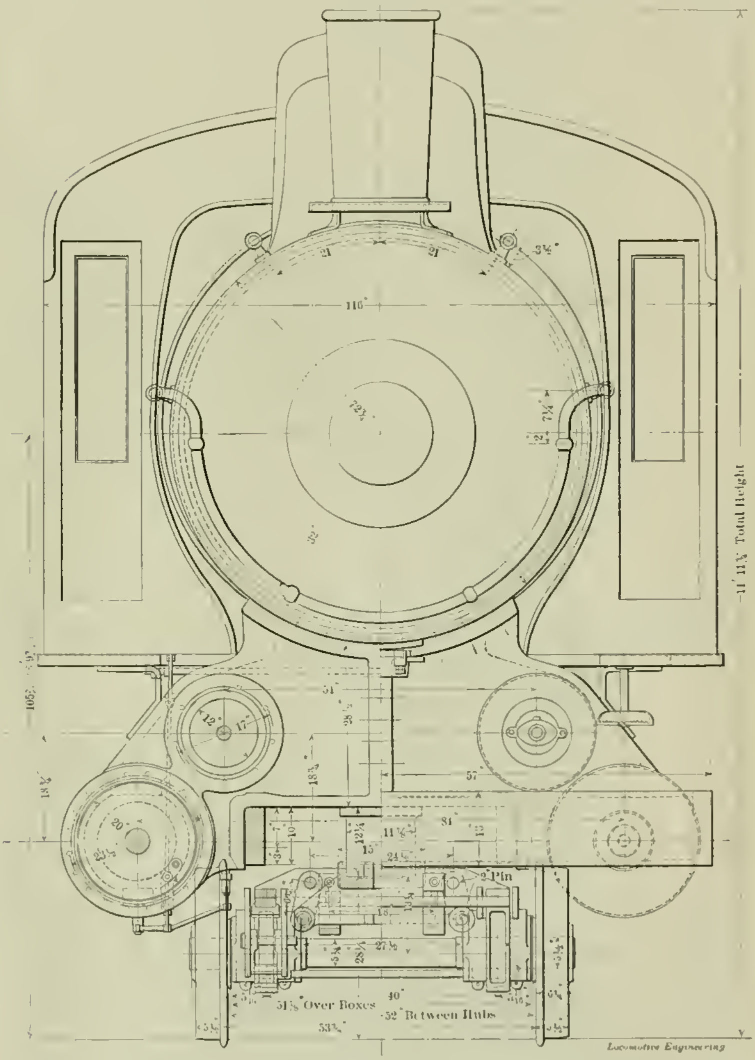
"The principal dimensions are: Cylinders, 10 inches diameter and 16 inches stroke; wheel-base, total, 17 feet 7 inches; boiler, 34 inches diameter, of 5-16 inch steel plate; firebox, 37 inches length by 30¼ inches width by 41 inches depth, of copper ½ inch thick; tube plates, ½ and ¼ inch; eighty-four tubes, 1¾ inches diameter; driving axle at journals, 5 inches by 6 inches; weight on drivers, 13 tons; tank capacity, 800 gallons.

"This invasion into our preserves may look like the insertion of the thin edge of the American wedge into locomotive engineering, but we dare say it will not cause undue alarm amongst those who are most interested."

Mr. Cross is convinced that the borings will work into the wood, solidify and prevent decay, and that it affords one of the simplest and best designs for foundations of machine tools.

The Falls Hollow Staybolt Company are enjoying a substantial increase in business, due partly to their lower price, which makes it unprofitable to drill or punch the bolts. Several orders have been received from Japan, indicating that our friends in the Far East appreciate good quality of material as well as convenience.

The newest and most ingenious machine in the wood-working line is the Chain Saw Mortiser, made by the New Britain Machine Company, New Britain, Conn. For car work or other mortising it beats anything we know of.



BROOKS TEN-WHEELER FOR GREAT NORTHERN.

Machine Foundations.

Mr. W. Cross, general master mechanic of the Canadian Pacific Railway at Winnipeg, Manitoba, has a new method of putting in foundations for his machine tools. The heavy tools which have been placed recently have been set with timbers, 5 by 11 inches, 6 inches apart, and tied with cross-timbers in the same way. The space is then filled with cast-iron borings, and makes a very solid foundation.

A Little Chat on Tractive Power.

BY R. E. MARKS.

There are too many engineers—some of the boys I know pretty well, too—who are not so well posted on some things about their engines as they might be. Tractive power is one of these. Some men I've met seem to think it's first cousin to combustion or something else they hear about but can't see.

Now, I don't blame men who are on the shady side of fifty for not wanting to tackle algebra, if they never had the disease before; but it's mighty handy to know a little, once in a while, and there's no excuse for a young fellow not knowing enough about it not to be scared at the sight of x, y and z. But as I'm not going to mention algebra here, no one need have hysterics.

Tractive power is the pull of the engine on the drawbar in pounds—not per anything; just plain 16-ounce pounds, same as a spring balance. To find this pull, we must consider the factors which do the pulling.

These are: Steam pressure which is effective in the cylinder, area of piston on which it acts, length of the stroke through which it acts and diameter of driving wheels. The way in which all of these act and how the figures cancel each other, was clearly shown in the issue of November, 1896. Suffice to say that the usual formula is

$$\frac{d^2 \times S \times M.E.P.}{D}$$

which reads: Multiply the square of the diameter by the stroke and by the mean effective pressure in the cylinder. Then divide this by the diameter of the wheel. When the stroke is taken in feet the diameter of driver must also be in feet, or both can be in inches. Some use one and some the other.

To get it down to its finest point, we can say—and ought to be able to remember, too—that the cylinder diameter squared equals the tractive power for 1 inch of stroke, 1 pound mean effective pressure with a 1-inch wheel.

It is customary to consider the maximum mean effective pressure as 85 per cent. of boiler pressure, and as the engine exerts its maximum tractive force or drawbar pull in starting, at long cut-off, this is the accepted figure.

Taking an 18-inch engine, we have $18 \times 18 = 324$ pounds pull for each pound mean effective pressure per inch of stroke for a 1-inch driver.

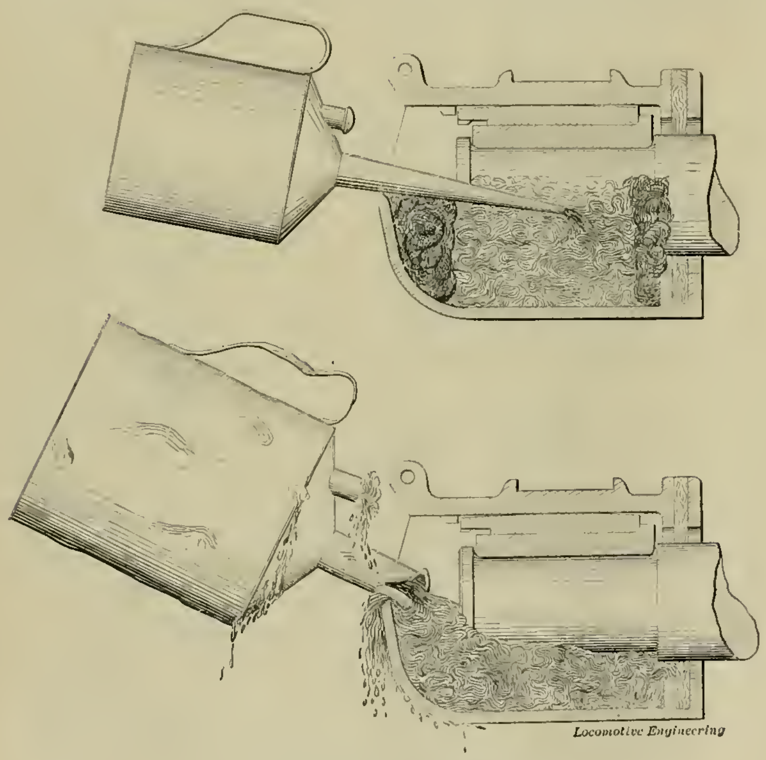
Calling boiler pressure 160 pounds, then 85 per cent. of 160 equals $160 \times .85 = 136$ pounds mean effective pressure. Then $324 \times 136 = 44{,}064$ pounds pull per inch of stroke; but don't forget that you are only considering a 1-inch driving wheel. A 24-inch stroke would give $24 \times 44{,}064$, or 1,057,536 pounds pull. Now see the effect of the size of wheel, and you'll see why the short-legged freight engines start the big trains.

Calling this a passenger engine, with 77-inch wheels, we divide 1,057,536 by 77 and get 13,734.3 pounds drawbar pull. Now put this same cylinder and pressure on an engine with 50-inch wheels and see the difference. Then we have 1,057,536 divided by 50, and find the pull to be 21,150.7 pounds.

If we lengthen out the stroke to 28 inches and multiply 44,064 by 28 instead of 24, we have 1,233,792 pounds, which divided by 50 gives 24,675.8 pounds drawbar pull.

This method makes an easy way to compare the capacity of engines mentally, as it is easy to remember that the square of the diameter of cylinder equals the tractive power for the unit of stroke, mean effective pressure and wheel. Thus if engines are alike, except that one is 24 and the other 28-inch stroke, you can see that the latter will have one-sixth greater pull than the former. On the other hand, if the former has a 60-inch wheel and the latter a 70-inch driver, the tractive power of each is the same, as the difference in stroke is balanced by the drivers.

It's a little food for thought among the boys who ask questions and show that they want to get along faster.



A STORY WITHOUT WORDS.

Fads and Fancies in Locomotive Building—No. 11.

The Raub engine has been making a new bid for popularity in the daily papers of the past few weeks. It has saved so much fuel and water and run so fast (on paper), that if a road only had two such engines, they wouldn't burn any coal, and could run eight miles a minute.

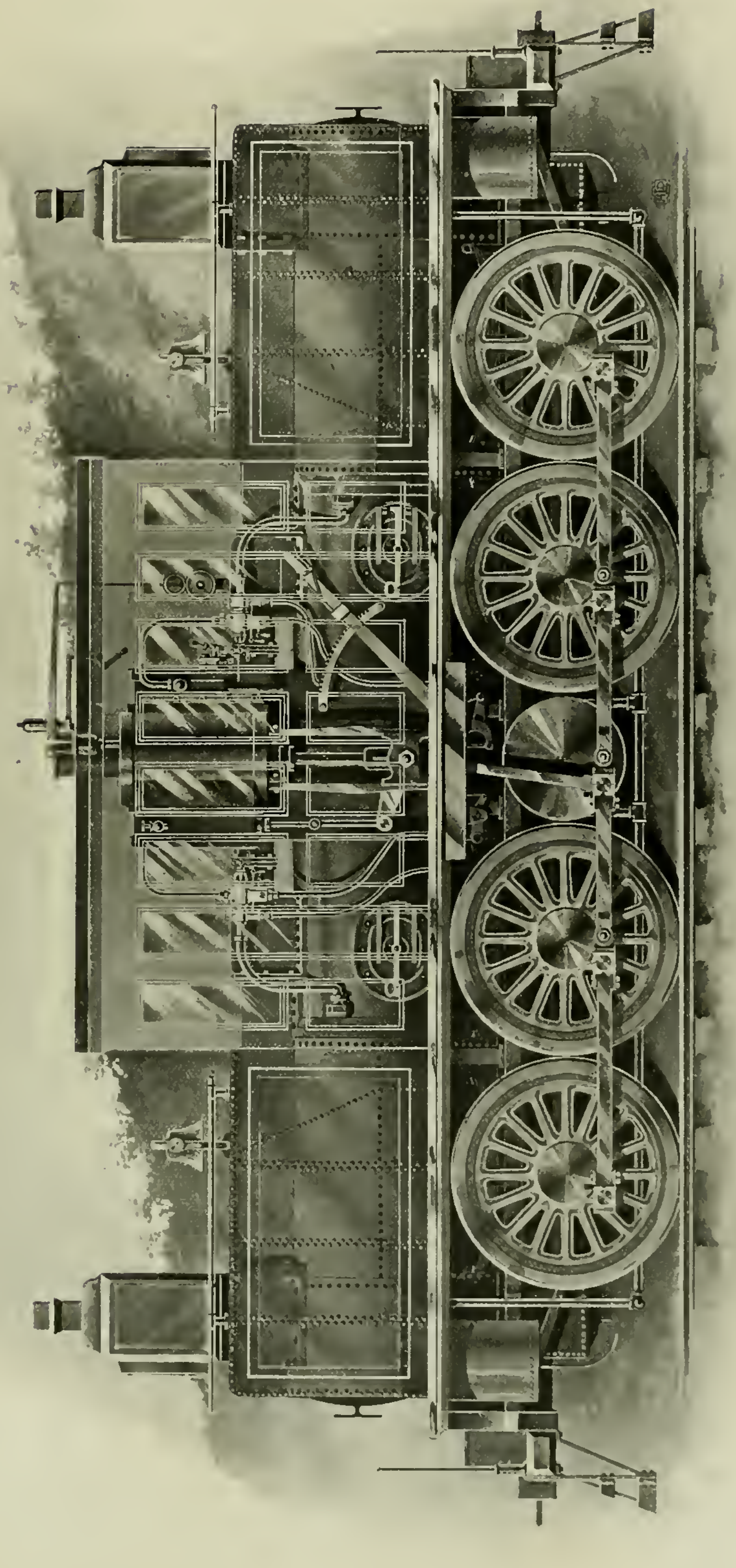
The description given in the January issue of 1894 called it "the great American junk shop on wheels," and the title is still effective in describing it.

There are two small boilers, each with a fire-door on each side and a smoke-flue coming back to a stack in the center. The engines are small, vertical affairs in the center, and are supposed to perform wonders, but—they haven't as yet.

There is little to be said of this alleged locomotive, except that it comes pretty near being the biggest freak of the lot, and that is saying considerable.

Only one has been built, and that has been in constant service—holding down rails in a shed in Paterson, N. J.—ever since it was completed. When they build another, it will be time to appoint a lunacy commission to examine the purchasers of the stock.

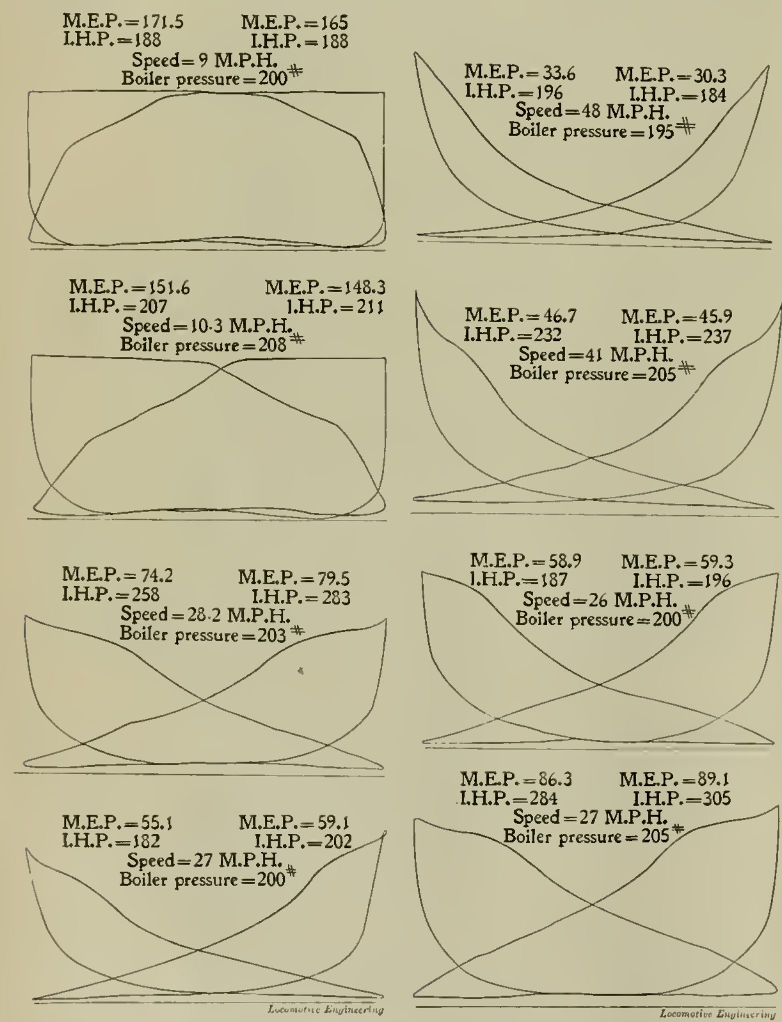
An article which attracted considerable attention at the late mechanical conventions was the automatic driver brake release. It looks something like a triple valve, and is piped to the steam chest and is connected with the triple valve. When the engine is reversed while the air brake is applied, the steam chest pressure releases the driver brakes while the others remain applied.



FADS AND FANCIES IN LOCOMOTIVE BUILDING—No. 11.
THE RAUB CENTRAL POWER LOCOMOTIVE.

Locomotive Tests—Great Northern Railway.

A test to show up the performance of the new Brooks engines on the Great Northern, in both passenger and freight service, was made recently, the results of which are herewith presented. The usual means taken to accurately measure the fuel and water consumption, temperatures, etc., were employed, as in all cases of such work, and indicator cards taken at suitable points most likely to give a favorable use of the throttle; but no attempt was made to get anything except results that would be obtained in every-day road practice, and on these grounds they are given as a contribution to the general collection of locomotive test literature, which with the cards will be found of interest after noting the factors through which the final figures were reached:



INDICATOR DIAGRAMS FOR GREAT NORTHERN LOCOMOTIVE.

	Passenger.	Freight.
Engine number	154	154
Date of trial	7-28-98	7-29-98
Length of run, miles	48.1	48.1
Mean temperature of the atmosphere, degrees	76	85
Condition of the rail	Good	Good
Size of exhaust nozzle, single, inches	5⅝	5⅝
Time on the road	2h. 17m.	4h. 35m.
Time made up in minutes	54	77
Aggregate intermediate stop, minutes	27	61
Time during which power was developed	1h. 34m.	3h. 10m
Max. speed, miles per hr.	49.5	33.8
Av. speed, miles per hour.	26.2	13.5
Max. rev. per min	264	180
Max. piston speed, feet per minute	1,320	900
Min. seconds per mile	72.9	106
Max. boiler pressure	210	210
Min. boiler pressure	185	165
Average boiler pressure	196.4	198
Prevailing position of throttle lift, inches	0.5	0.5
Prevailing throttle open'g, square inches	16.6	16.6
Prevailing cut-off, inches	7 & 10	7, 10 & 18
Prevailing cut-off, per cent. stroke	23 & 33	23, 33 & 60
Weight of train in tons of 2,000 pounds, inclusive of locomotive and tender	289	549
Weight of train, exclusive of locomotive and tender, tons	157	417
Weight of train, exclusive of locomotive and way car, tons	—	410
Number of cars	5	11
Total weight of coal consumed, pounds	7,300	11,600
Number of miles per ton of coal	13.2	8.3
Pounds of coal used per mile	152	241
Coal used per 100 tons of train per mile	52.7	44.0
Weight of coal burned while throttle was open, pounds	7,050	11,300
Average weight of coal burned per sq. ft. of grate per hour, pounds	127	101
Weight of water drawn from tank, pounds	35,000	59,600
Waste of injector	225	240
Weight of feed water, pounds	34,775	59,360
Temperature of feed water, degrees	56	56
Water used per mile, lbs.	724	1,235
Water used per 100 tons of train per mile	251	225
Water used per hour, lbs.	22,160	18,750
Water user per sq. ft. of heating surface per hour, pounds	8.28	7.01
Water used per sq. ft. of grate surface per hour, pounds	626	529
Actual evaporation per pound of coal, pounds	4.93	5.27
Equiv. evaporation from and at 212 deg. per lb. of coal, pounds	6.00	6.40
Max. I. H. P. develop'nt.	1,468	1,116
Aver. I. H. P. develop'nt.	922	839
Coal per I. H. P. per hr., pounds	4.87	4.26
Water per I. H. P. per hr., pounds	24	22.4
Aver. number of sq. ft. of heating surface per I. H. P.	2.9	3.19
Aver. number of I. H. P. per sq. ft. of grate surf.	26.1	23.6
Max. grade, feet per mile.	116	116
Aver. rise, feet per mile	64.7	64.7

Motor Versus Horse.

Trials have recently been made in London to supersede the horse in haulage of mail from the General Post Office to sub-stations. Oil, steam and electricity were the motive powers tried, to determine their relative commercial value in doing the work. No facts are at hand on which to base a comparison with the horse against oil, but since the performance of the motor did not come in for condemnation, it is fair to assume that it was a favorable one.

Steam and electric motors also gave results in the same service, that left no doubt as to their economy for the work. There is no doubt about the saving of time by the motor method of mail distribution to sub-stations; it has long been the practice in New York city to convey mails to the uptown stations and the Grand Central Railway station, by coupling the mail car to the regular street railway electric cars; these mail cars being fitted up so as to facilitate the sack distribution by the mail agents while en route. This system is found perfectly satisfactory in meeting the requirements of this feature of the mail service.

An illustrated catalog has been issued by the Dickson Locomotive Works, which contains fine engravings illustrating the various kinds of locomotives made by the company. It also contains a great deal of useful information about the hauling capacity of locomotives, and other facts that are highly interesting. There is a very good description of the compound locomotive built by the company. The automatic starting valve shown is one of the best pictures of the kind we have ever seen.

Pike's Peak and Its Railway.

BY M. F. JUKES.

In November, 1806, Major Zebulon M. Pike discovered the well-known mountain which bears his name, and, accompanied by three companions, attempted its ascent in the latter part of the month, but failed, as during that season the summit was blocked with snow and its ascent was practically impossible. The first successful attempt was not made until July 14, 1819.

Nowadays, anyone that can stand the altitude is able to reach the top by means of the world-famed "cog road" (as it is called in this part of the country), the Manitou & Pike's Peak Railroad.

The road proper starts from Manitou, at the base of the mountain, and in about nine miles, going at the average rate of six miles per hour, rises from an altitude of 6,629 feet to 14,147 feet, or over 7,500 feet; the average grade being 16 per cent., or 845 feet to the mile. The road was finished in 1890, and was constructed upon the Abt system, like a number of other mountain roads, including the Mt. Pilatus, having a grade of 48 per cent. The roadbed is much wider than for ordinary track, and of necessity has to be more substantial, as the weight of the track tends to its creeping or sliding on the heavier grades. To counteract this tendency, anchors are placed at distances varying from 200 to 1,400 feet, according to the grade.

The track (4 feet 8½ inches) is laid with 40-pound carrying rails, between which are the two lines of rack cut from solid Bessemer steel. The rack rails are made in pieces 6 feet 8 inches long, and weigh from 60 to 90 pounds per yard, according to the grade—the 25-per-cent. grade of course using the heaviest. These rack rails are set staggering, so that between the two rails and four cog-wheels there are always two surfaces where there is direct pressure between the teeth of the cogs and racks. If any of the pictures showing the track (No. 1 or 2 will show it best) be examined closely, the observer will see its construction easily.

The locomotives, as will be seen at first glance, are necessarily different in almost every respect from the ordinary machine. On the road they are all Baldwins, the first of which was built some nine years ago, and which will be seen in the first illustration. The others are of later design, having the Vauclain compound feature and a different system of levers and cranks. The latter design is illustrated in Fig. 2, which shows engine No. 4. These engines have cylinders 9 and 15 inches x 22 inches, and their boilers carry 200 pounds of steam per square inch. They are carried upon six ordinary wheels and propelled by four cogs, two each on both the leading and intermediate axles. The engine is never connected to the car, but always has it in front, pushing or holding it back, as the case may be. The engines and cars are both fitted with pinion brakes, and the engines have hand, steam and water brakes. The Le Chatelier water brake, which acts as an air compressor, will not need mentioning here, as it has already been described in a recent number of LOCOMOTIVE ENGINEERING.

FIG. 1—FIRST ENGINES USED ON M. & P. P. RY.

FIG. 2—THE LATEST ENGINES ON THE M. & P. P. RY.

The coaches used on this road are nothing more nor less than ordinary observation cars composed almost of windows.

The ascent of the road is something that no one visiting the State of Colorado should miss. The scenery is a huge changing panorama, growing more vast and wonderful the higher one gets. Not the least of Colorado's sights is the great amount and variety of color. Half way up the engine takes water. Not many engineers can say that they take water as often for the number of miles run as the men on this road. It is really an inspiration to hear the little engines as they cough and bark in their efforts to get the car to the top of the hill. At 11,580 feet the timber line is passed, and for the rest of the way the ground is rocky and broken. No vegetation can be seen, except it be some hardy lichens and mosses.

When one reaches the top, which is first seen from Windy Point, at a distance of 2¼ miles, the scene that greets the eye is truly bewildering, and the person whose poetic feeling is not aroused must indeed have either a head or heart of stone. One can see for hundreds of miles in every direction. The beautiful snow-clad Sangre de Christo range to the West; to the North one can pick out Denver, 75 miles away, and the Continental Divide. The plain and rivers spread out like a map to the East, and directly below you can see the city of Colorado Springs and Manitou, where the springs really are. To the southward one can pick out Cripple Creek, the famous mining camp; the city of Pueblo, many other camps and villages, also Seven Lakes and the Raton Mountains, in New Mexico. Lastly, but not by any means the least, is the most wonderful and glorious sight of all—the sunrise as viewed from the summit. It is a sight the grandeur of which

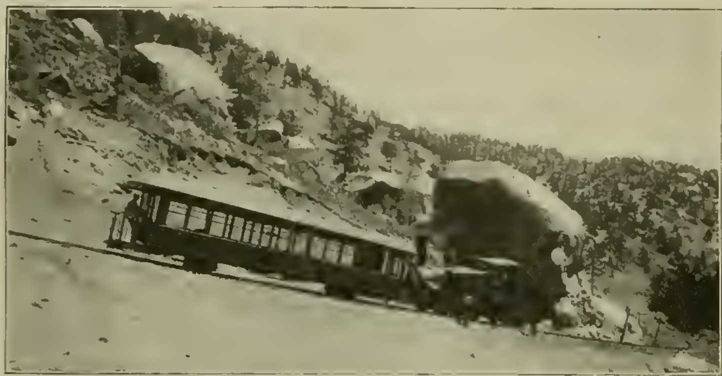


FIG. 3—PHANTOM CURVE.

I feel incapable of describing. The photo which shows it gives one but a faint idea of the glory of the sight, and the photograph itself loses much of its original beauty in reproduction. This picture, which, by the way, is one of the most

FIG. 4—VIEW OF 3½ MILES OF ROADBED.

wonderful views that has ever been made, was taken by Mr. Fred P. Stevens, of Colorado Springs, and, with any of the other views, can be obtained from him.

The views other than I have mentioned are as follows: No. 3, Phantom Curve, with engine No. 1 and coach; No. 4 shows 3½ miles of the cog-road; No. 5, United States signal station and train; No. 6 was taken on June 15, 1894, and shows the amount of snow on the summit at that time of the year

Glory for the Conductor Again.

A newspaper clipping recently gathered in reads:

"Captain Watkins, commander of the 'Paris,' is an old sea dog of the first order. No living navigator knows the North Atlantic better. This is not the first time he has performed a similar feat of seamanship.

"Nearly twenty years ago, when in command of the 'City of Brussels,' as commodore captain of the Inman Line, he had a breakdown in the shape of a broken shaft shortly after leaving New York. Captain Watkins had all sail set, and was able partially to handle his ship while she was drifting a long way southward. He was several times spoken and offered assistance, but this he refused. He ultimately came home all right. As the 'City of Brussels' sailed into the Mersey, decked in a full suit of bunting, she was greeted by enormous crowds both on water and land, and Watkins got the reception of a conquering hero."

It is all very well to give the Captain his own share of the glory of bringing a disabled steamer into port, but it is quite an unjust proceeding to ignore the stupendous labors of those who rendered assistance from other vessels unnecessary. Away down in the depths of the ship a band of grimy engineers sweated and toiled to such good purpose that they repaired the broken shaft and made it sufficiently strong to work the propeller and drive the vessel into port. These men did all the work required to put the steamer into working order, and the gold-laced man on the bridge got all the glory. Just the same thing as the conductor who made a splendid run while lounging in the caboose.

Convenient Uses for Malleable Iron.

The usual form of forged tank lug for bolting the tank to the tender frame is quite an expensive forging. Mr. Conolly, of the Duluth, South Shore & Atlantic, now makes these of malleable iron, which does the work just as well, and at a considerable saving. They have in use a novel form of combined washer and nut lock on wooden brake beams and other parts of trucks. Malleable-iron washers are used in many ways. When possible, lugs are cast onto the washers, arranged so that a wire nail run through these lugs, clinched on the bottom, acts as a nut lock. The holes in the lugs and for bolts are cored, making the cost of the washers but trifling. Malleable castings are very largely used on this road. They were, we believe, the originators of the malleable-iron brake-rod jaw or fork.

Ingenious Means of Measuring Water Power.

In the course of a long article advocating the metric system, sent us by Mr. R. J. Callandar, C. E., Ceara, Brazil, the following interesting incident is told:

"About fifteen years ago, whilst engaged in railroad reconnoissance and billeted for the night at a 'fazenda,' I was asked by the owner to find, next morning, the power of a running stream in his property. Having with me only note-books and pencils, aneroid, pedometer and a Gurley mountain-transit, my night's rest was troubled with visions of unobtainable Boyden gages, Pitot's tubes and Révy current-meters; but when I awoke I was not beaten. I had a watch with me, and remembered my school notes about a 39-inch-and-something pendulum beating seconds; so I clinched a bullet to one end of a thread and adjusted the length until it swung about 60 beats to the minute.

"'There, I said, you have an approximate measure of length, and please to give it me in meters—39⅜ inches are a meter, and three-eighths of an inch are a short centimeter; consequently my measure is about 99 centimeters long.' So I marked on a slat the length from the center of the bullet to the point of suspension, and with a slip of paper divided that length into 3 times 3 times 11 parts; added one of those parts and obtained a working meter divided to centimeters; doubled and trebled this; numbered the divisions, and in a short time had improvised a very serviceable leveling-rod.

"I surveyed the stream and fazenda surroundings by means of the stadia wires in the transit telescope, and used its level for the leveling. A knotted rope for cross-sectioning, the improvised rod for sounding, and timed floats, furnished an approximation to the volume, and the levels gave the fall.

"I then said: Seventy-five kilograms falling one meter in one second are a horse-power; and assuming a 75 per cent. efficiency for a water machine, each I. H. P. would require 100 kilogram-meters or 100 liters, equal to 100 cubic decimeters, of water falling through one meter per second.

"The measurements gave, I think, 15 effective horse-power, and some months afterwards the owner told me he had made a flume and put up a wheel, which, according to trials, developed about the promised horse-power. The difference was of no moment; it did the work he wanted done.

"To 'make assurance doubly sure,' I recollect taking with me, on returning to my camp, about 40 inches' length of the scale in order to compare its improvised meter. This was only a few millimeters in error, and certainly not a worse measure than some of the misfit scales exported to transoceanic countries."

FIG. 5—U. S. SIGNAL STATION AT TOP.

A class of locomotives on one of our principal railroads once had a long drawbar between engine and tender, which was coupled to a casting beneath the deck. It was a design that no one with experience in the practical work of heavy freight locomotives would have used. One day the inevitable happened. A break in two permitted some cars to come in violent collision with the tender. The drawbar casting broke and the drawbar went through the water leg. The enginemen were badly scalded, and a reporter wrote that the accident was caused by the explosion of a drawbar.

First Specification for an American Locomotive.

Those who are familiar with railroad history are aware that the Baltimore & Ohio Railroad Company, being the pioneer of American railroads, had to originate a great part of the machinery for train operating. About the time the first division was ready for business, the directors determined to advertise for locomotives, and the following curious announcement was issued:

Office of the Baltimore & Ohio Railroad Company.

January 4, 1831.

The Baltimore & Ohio Railroad Company, being desirous of obtaining a supply of locomotive engines of American manufacture, adapted to their road, the president and directors hereby give public notice that they will pay the sum of four thousand dollars for the most approved engine which shall be delivered for trial upon the road on or before June 1st, 1831; and they will also pay three thousand five hundred dollars for the engine which shall be adjudged the next best and be delivered as aforesaid, subject to the following conditions, to wit:

1. The engine must burn coke or coal, and must consume its own smoke.

2. The engine, when in operation, must not exceed 3½ tons weight, and must, on a level road, be capable of drawing, day by day, 15 tons, inclusive of the weight of the wagons, 15 miles per hour; the company to furnish wagons of Winans' construction, the friction of which will not exceed 5 pounds to the ton.

3. In deciding on the relative advantages of the several engines, the company will take into consideration their respective weights, power and durability, and, all other things being equal, will adjudge a preference to the engine weighing the least.

FIG. 6—TAKEN JUNE 15, 1894, SHOWING SNOW AT TOP

4. The flanges are to run on the inside of the rails. The form of the cone and flanges, and the tread of the wheels, must be such as are now in use on the road. If the working parts are so connected as to work with the adhesion of all the four wheels, then all the wheels shall be of equal diameter, not to exceed 3 feet; but

if the connection be such as to work with the adhesion of two wheels only, then those two wheels may have a diameter not exceeding 4 feet, and the other two wheels shall be 2½ feet in diameter, and shall work with Winans friction wheels, which last will be furnished upon application to the company; the flanges to be 4 feet 7½ inches apart from outside to outside; the wheels to be coupled 4 feet from center to center, in order to suit curves of short radius.

5. The pressure of the steam not to exceed 100 pounds to the square inch; and as a less pressure will be preferred, the company in deciding on the advantages of the several engines, will take into consideration their relative degrees of pressure. The company will be at liberty to put the boiler, fire tube, cylinder, etc., to the test of a pressure of water not exceeding three times the pressure of the steam intended to be worked, without being answerable for any damage the machine may receive in consequence of such test.

SUNSET ABOVE THE CLOUDS—PIKE'S PEAK.
Copyright by F. P. Stevens, Colorado Springs, Col.

6. There must be two safety valves, one of which must be completely out of the reach or control of the engine man, and neither of which must be fastened down while the engine is working.

7. The engine and boiler must be supported on springs and rest on four wheels, and the hight from the ground to the top of the chimney must not exceed 12 feet.

8. There must be a mercurial gage affixed to the machine, with an index rod showing the steam pressure above 50 pounds per square inch, and constructed to blow out at 120 pounds.

9. The engines which may appear to offer the greatest advantages will be subjected to the performance of thirty days' regular work on the road; at the end of which time, if they shall have proved durable and continue to be capable of performing agreeably to their first exhibition, as aforesaid, they will be received and paid for as here stipulated.

P. E. Thomas, President.

N. B.—The railroad company will provide and will furnish a tender and supply of water and fuel for trial. Persons desirous of examining the road or of obtaining more minute information, are invited to address themselves to the president of the company. The least radius of curvature of the road is 400 feet. Competitors who arrive with their engines before June 1st will be allowed to make experiments on the road previous to that day.

The editors of the *National Gazette*, Philadelphia; *Commercial Advertiser*, New York, and *Pittsburg Statesman*, will copy the above once a week for four weeks, and forward their bills to the Baltimore & Ohio Railroad Company.

Coal and Oil at Way-Stations.

A committee of the Railway Superintendents' Association has recommended that:

"Coal stored at way stations should be kept in a small house holding from a half car load to a car load of coal. Locate the house about 100 feet from the station, on account of danger from fire, and, if possible, near a track, so the coal can be unloaded directly from the car through a trap-door in the roof of the coal house. Partition off one end of the coal house for an oil house, of a size sufficient to suit the needs. Build a counter across one end, and cover it with zinc. Build a shallow box under the counter, and fill it with sand, so the oil will not soak into the floor. Place a ventilator in the roof to carry away all gases and line the inside of the house with tin or zinc, to guard against fire.

"A shallow cast-iron pan with a grating over the top, to catch the oil while the lamps are being filled, should be placed on top of the counter. This catches the waste oil.

"Where the size of the station warrants it, the coal and oil house should be built of brick and provided with iron doors and shutters. No oil or coal should be stored in the freight house, as it is a constant source of danger from fire and often damages freight.

"Oily rags, waste, etc., should be kept in a galvanized-iron pail with a cover, to guard against fire from spontaneous combustion."

Some capitalists have formed a company to build a railroad from Colorado Springs to Cripple Creek, a distance of twenty-five miles, and the estimated cost is $700,000. The intention is to use the Pike's Peak cog railway part of the way. It is reported that the new railroad will be operated by electricity, generated by a waterfall a short distance from Cripple Creek.

Admires Gilderfluke's Locomotive.

The *Cape Argus*, Cape of Good Hope, dishes its readers weekly a repast of all the newest world wonders. A recent issue says:

"It would be a safe bet that not one out of a hundred, even of the intelligent readers of Saturday Sallies, could give any idea what a Gilderfluke is. Yet even a thing possessing this fearful name is capable of being explained. It is another outcome of the enterprise and smartness of American mechanics, and in the railway world appears to have eclipsed all previous efforts. A drawing of the marvellous contrivance recently appeared in the Locomotive Engineering, and filled with awe and wonder I ventured to ask a fully qualified engineer (nothing else but 'fully qualified' would have sufficed) what he thought of it. Somewhat to this effect did he reply: 'Though apparently somewhat complicated, the engine is a marvel of carefully thought-out detail and scientific management; the novel features giving the advantages of both simple and compound engines, fast running and hill climbing, great traction power and quick stopping. The special fuel-saving arrangements are most original, and when perfected will no doubt convert an inferior fuel into a by-product of great value. To show how thoroughly the designer has gone into even small items of saving on running expenses, the sand that is used in damp weather is re-collected and returned by an ingenious device to the sand box.'"

The list of weights of M. C. B. couplers, as reported by the manufacturers and furnished by Secretary Cloud, while incomplete in that all builders of couplers are not represented, still possesses enough data to be a useful reference. One important fact is noted, namely, that the weight still lingers from 220 pounds up. While the weight does not affect the price materially, it does have a bearing on dead load, and should be reduced wherever possible to do so.

Practical Letters from Practical Men.

All letters in this Department must have name of author attached.

The Palm & Robinson Locomotive Works.

Editors:

In reply to a query regarding the Palm & Robinson Locomotive Works, of St. Louis, the following very interesting letter was received:

"I regret that I have no drawings or pictures of the locomotives built by the Palm & Robinson Works, at St. Louis, Mo. Palm & Robinson had been engaged in the foundry and general machine business in St. Louis, and when the internal improvements in Missouri commenced to build railroads, they made arrangements to build locomotives. In July, 1852, Mr. James Tull, who had been for some years superintendent of the Norris Brothers Locomotive Works, of Philadelphia, was engaged as superintendent, to start the work for Palm & Robinson; and I being a graduate of the Norris Works, Mr. Tull took me with him to assist him. Mr. Tull went to St. Louis September, 1852, to complete negotiations. In November, 1852, I started from Philadelphia for St. Louis, having Mr. Tull's family in my charge on the trip, which at that time took six weeks to accomplish, leaving Philadelphia over the Pennsylvania Railroad to Altoona, Altoona to Johnstown by stage coach, Johnstown to Pittsburg by Pennsylvania Railroad, Pittsburg to St. Louis, down the Ohio and up the Mississippi rivers. We stuck on every sand bar in the Ohio River from Pittsburgh to Cairo, in some cases as long as forty-eight hours.

"Many difficulties presented themselves in commencing to build locomotives—want of competent mechanics, want of proper tools, etc. Mr. Tull arranged to bring a number of expert mechanics from the East, principally from Philadelphia. We also arranged and built a number of tools, slide lathes, planers, drill presses, bolt headers, etc. A driving wheel lathe was furnished by Bement & Dougherty, of Philadelphia. These preparations consumed about four months. Drawings being completed during this time and patterns made, active work on locomotives commenced in May, 1853, and the first locomotive, a 16 x 22 for the Missouri Pacific Railroad, was completed and delivered in July, 1853. This was followed by four more during the year for this same company. During the year one locomotive was built for the St. Louis & Bellville Railroad, afterwards the Cairo Short Line, and now operated by the Illinois Central; also six locomotives for the Western division of the Ohio & Mississippi, now the west end of the Baltimore & Ohio Southwestern. The first lot of ten engines were built at these shops the succeeding years for the Iron Mountain and North Missouri railroads, also two for the Keokuk & Burlington. In 1859 locomotive building was discontinued by Palm & Robinson. From 1853 to 1859 fifty-four locomotives were built. After this the firm dissolved and the works discontinued, and I then commenced with the Missouri Pacific Railroad, first as assistant to the master mechanic, Mr. Charles Williams, and in 1865 was promoted to general master mechanic of that road, succeeding Mr. Williams.

"Very truly yours,

JACOB JOHANN."

FIRST PULLMAN SLEEPER.

Locating a Lame Exhaust.

Editors:

While an uneven exhaust is not always an indication of bad steam distribution, it is a thorn in the side of the average locomotive runner, or rather a discord in his ear. Some designers of valve motion insist that the sound of the exhaust is not of much consequence when it is possible otherwise to secure an indicator card that shows greater economy. While this may be theoretically true, practice proves that the sound of the exhaust is about the only guide the engineer has as to the working of his engine, and if this is uneven at the start, it is impossible to detect the slight changes that are quickly perceptible when the engine was originally "square."

So if an engine which was in good shape, after a few months of service, begins to go heavy on one side, it shows that the steam is carried farther in the stroke on that side and that the valve is delayed in cutting off.

In such a case look for a badly worn

link hanger or a sprung lifter arm, or possibly the box supporting the tumbling-shaft is low or badly worn on that side.

The best remedy is, of course, to restore the parts to their original position by repairs in the back shop; but if this cannot be immediately done, raise up the tumbling-shaft on the heavy side by liners under the box, or otherwise, until the beats sound of equal volume.

When three of the sounds are of equal volume, but the fourth one comes late and heavier, it will indicate, if the eccentrics are properly set, that one of the eccentric rods is too long or short, depending from which end the heavy exhaust comes.

Here is where the difficulty of many runners comes, and men who are old in the business often cannot tell for a certainty whether the heavy sound comes on the center or the quarter.

Some imagine that a cylinder exhausts after the crosshead reaches the end of the stroke, and that the piston pushes the exhaust steam up the stack. While the latter is lamentably true in some cases, with the very small nozzles used, it is a mistake to not know that the exhaust is released before the completion of the stroke by a varying amount, depending on the point of cut-off.

At full stroke it may be heard when the crosshead is within two inches of the end, but with the lever on the center, if it can be heard at all, it will come at the middle. So that it should be looked for between the middle and near the end of the travel.

Now, in a supposable case, if the heavy beat comes just before the end of the stroke on the front center on the right side, and in backing with the lever in the same relative notch of the quadrant the exhausts are square, it will show that the forward motion or top eccentric rod is too short, and that it requires to be lengthened a little. Do this in small amounts, not over a sixteenth of an inch at a time, until the result is satisfactory.

When two or more beats are out and "catch a nigger," or other similar jigs are played, it will require considerable experience to properly locate them, and even then the wisest are often fooled.

A case of lameness sometimes comes from a sprung valve yoke, a loose false seat, or a poorly fitting yoke on the valve.

Any one of these defects cannot be found by the common method of tramming, but when unable to locate the trouble at any other point, the steam chest covers must be lifted and the parts repaired.

A blow may at times sound like a bad exhaust, but the difference is generally easily discerned, and it occasionally has been found to be in the right side of the cab.

Peculiar or whistling exhausts may be due to the trick of some fireman who has tried to improve the steaming qualities by slipping a U-shaped piece of flat iron over the partition between the blast holes. It is well at such times to investigate the front end before looking elsewhere.

FRED E. ROGERS.

Corning, N. Y.

INSIDE OF FIRST PULLMAN SLEEPER.

It is not generally known that the second railroad built in this country for the transportation of passengers, was that bit of track laid between Schenectady and Saratoga in 1833, and that date is eighteen years after the erection of Congress Hall at Saratoga, a name familiar to the members of the Master Mechanics' and Master Car Builders' Associations. Antedating these was the discovery of the Congress Spring in 1790. This rugged old bubbler, with its businesslike cathartic properties, is perhaps better known than any other spring in this counry. The road and country through which it was built abounds richly with historic matter.

The Canadian Pacific Railroad is about to establish another trans-Pacific line of steamers, to run between Vancouver and Vladivostock, to connect with the new trans-Siberian railroad. Old mother earth is being girdled in almost every direction in the interest of commerce, which also means civilization.

Oils and Oiling Driving Boxes.

Editors:

One of the most difficult problems that a railroad company has to deal with to-day is, to determine which is the best oil for lubricating locomotive driving boxes. The oil manufacturer of to-day is in a position to produce almost any grade of oil that is desired, if the consumer is able to furnish him with intelligent specifications to work to. It is an easy matter to get testimonials from oil manufacturers, but such data are of little value unless full information is obtainable in regard to the conditions under which the oil was used, either in a road test or laboratory test. There are many so-called "cooling" compounds in the market, which in some cases give fairly good results. These compounds consist principally of common soap, graphite and a product which resembles paraffine oil, together with a certain percentage of water, or other volatile substance. The philosophy of the material seems to be, that the volatile matter vaporizes as the bearing gets hot, and this keeps it cool, while the grease serves as a lubricant. The soap probably helps to keep these things together. These compounds should be used in cellars only, and the waste next to the journal removed after the desired results have been obtained, as they leave a hard deposit of inert matter on the waste, which prevents the capillary feeding of the oil up to the journal. It is sometimes claimed (and probably true) that a hot driving box or a hot crank pin is made to run cool by the admixture of graphite or other inert matter.

When a bearing becomes hot, from whatever cause—either neglect of lubricating, poor oil or mechanical defects incident to wear—the metal expands and the parts are brought in so close contact with each other that the oil is incapable of penetrating between them. It decomposes very rapidly and is unable to absorb the accumulating heat; but when plumbago or other finely divided matter is used, it is drawn between the surfaces which fill and accumulate in the interstices of the bearings, absorbing a large percentage of this heat, which it transfers to the oil.

In the Pennsylvania Railroad Company's laboratory at Altoona, samples of oils are received from the various shippers who wish to furnish this company with their product. A chemical analysis is made of these samples, which represent certain shipments, and the acceptance or rejection of any particular shipment depends upon the results of the analysis of these samples.

In some cases a revolution friction test is made, in order to determine the coefficient of friction of the oil. A Thurston oil-testing machine is used, the construction of which is well known, consisting of a car journal mounted with a pulley, so that almost any desired number of revolutions per minute can be obtained, corresponding to certain speeds in miles per hour.

The desired loads in pounds per square inch on the journal are obtained by the compression or elongation of the spring in the pendulum of the machine. This is, I believe, the most satisfactory method yet devised for a practical test for determining the physical quality of an oil. Unfortunately, however, laboratory tests are, as a rule, too small to obtain entirely satisfactory proof of the merits or demerits of an oil for lubricating locomotive driving boxes in which there are so many interfering influences, such as the vibration of the locomotive, hot sun in the summer and the cold in the winter. The flying cinders and dust are taken up by the oil and grinds out the bearing, causing abrasion of the metal, resulting in hot boxes.

An essential requirement in an engine oil is capacity to resist decomposition by heat, and this is an important factor in the problem of oiling driving boxes under engines burning anthracite coal. I have seen engines leave the roundhouse with a new fire "pushed all the way down," and the back axle so hot that the hand could not be held on the ends of it, the boxes being much hotter. Anyone can see the fallacy of oiling these boxes with the ordinary engine oil, and it is highly probable that if a more viscous oil (cylinder lubricant) was used when the boxes are in

INSIDE OF FIRST PULLMAN SLEEPER.

this condition, better results would be obtained and the number of hot boxes reduced. The more viscous oil clings to the bearing surfaces and prevents them from becoming dry, but it is a little slower getting to the bearing. Still further, the more viscous oil having a higher fire test, it will stand a higher temperature, which permits the box to run a longer time without heating. When the engine has started with the train, the comparatively cool currents of air passing around the boxes will lower the temperature, while the heat due to friction will be kept low by the lubricant, unless something takes place which disturbs the conditions of the surfaces of the bearing. If the oil pipes are so located that the engineman can drop some oil on the boxes occasionally, much better results would be obtained than if all the oiling was done at the station before starting. Of course, there are periods when a driving box has been kept thoroughly oiled, and yet suddenly gets hot without any apparent cause. This is, in all probability, due to a gradual change in the bearing caused by dust or grit in the oil, which abrades the bearing and prevents the oil from reaching it freely.

The writer was at one time connected with an important terminal roundhouse of one of the leading railroads, on which a very large percentage of the passenger locomotives were equipped with water pipes to the front and back driving boxes. An order was issued by the superintendent of motive power to remove the water pipes from the front boxes, and the general opinion among the enginemen was that the boxes would be burnt up, and that it would be impossible to run the boxes without the water pipes. Some difficulty was experienced for a few days, but after the waste had become saturated with oil, there was a decrease in the number of front boxes getting hot. The water pipes, however, were not removed from the back boxes.

It is well known that water will keep a bearing cool if it is supplied fast and lavishly enough, but of all liquids it is certainly the poorest lubricant—in fact, I do not think that it lubricates at all, but simply dissipates the heat, and the journal and box are both being worn away very rapidly during its application. It causes the metal to "drag out," closing up the oil holes, and in order to keep the engine in service the box must be run in water until it is refitted or renewed. When an engine is turned out of the shop with new bearings, a heavy oil should be used for getting the boxes down to a high-speed bearing, as the more limpid engine oil will run off the surfaces. No matter how good a bearing is made in the shop, it cannot approach the perfection of one obtained by ordinary wear, as there is not perfect contact of the surfaces in the newly fitted bearing, and it is apparent that it is necessary to use a more viscous oil that will cling to the surfaces and prevent hot driving boxes on the trial trip. If a driving box is allowed to get hot when engine is being "broken in," and water is used, the box contracts in cooling, so that the bearing is entirely changed, and it is probable that this box will continue to give trouble until it is refitted.

This article is not written as a discussion of the merit of a high or low fire test oil for use in driving boxes, but to illustrate in a practical way that when a driving box is at a high temperature—or hot—due either to heat of fire from firebox or due to friction, it is fallacy to use the ordinary engine oil.

It is well known that the vaporizing point of an oil for lubrication should be in proportion to its capacity to absorb heat as fast as it accumulates, and the higher the vaporizing point of the oil, the longer it retains the heat and the longer it affects the bearing, and *vice versa* for an oil having a low vaporizing point, which keeps the temperature of the bearing proportionally lower, except, as stated, when the box is very hot.

S. J. Dillon.

Jersey City, N. J.

Warming Passenger Coaches.

Editors:

In your October issue, under the heading "Warming Passenger Coaches," is the following clause: "There is, however, a phase of the warming question right here, that is fully equal to anything yet produced by the coldest pan, and that is, the torridity induced by an indolent train hand on our steam-heated trains."

In this connection allow the pioneer, and an old veteran in car heating, to add a few words. In using steam from the locomotive, either directly or from exhaust, it is almost an impossibility for the brakeman, or anyone else, to control the temperature of the car, simply because the steam, if it exists at all in the heating pipes run within the car, must be at least at the high temperature of the lowest temperature of this fluid. A fairly equable temperature might be maintained by having some intelligent person watch thermometers in all the habitable parts of the car, and not otherwise, although, at the feet of passengers, the scorching of shoe-leather might give the alarm.

Now the only plan admissible is to have the heating pipes always at a temperature a safe distance below a scorching point, and thus assure the desired temperature on the same principle that the clothing is adjusted to the weather. You might as well contend that heavy woolen clothes might be comfortable in hot weather, as to argue that scorching hot steam pipes may fill the bill after the air within the car is warmed up to the comfortable point. No; the 212 degrees temperature—the lowest temperature at which steam exists—will always make the radiating or heat-transmitting pipes exposed within the car uncomfortably hot, and no amount of adjustment can arrange it otherwise. This matter your humble servant has made almost a life-long study of. Steam may be employed in a scorching condition, but never as the immediate agent for comfortably imparting its heat to railroad passengers.

Wm. C. Baker.

Wants Condensing Locomotives.

Editors:

While it is doubtless a fact that coal economy exists in a properly designed compound engine, and while I advocate the compounding of locomotives for the purpose of coal economy, I cannot say I have gone "daft" over the performance of any compound engine I have seen or read of yet. It occurs to me that said compounding is as yet in rather a crude state, inasmuch as all steam from low-pressure cylinder, with its wealth of energy and heat, is exhausted direct to atmosphere. Now with the stationary and marine engines (compounds) very little steam, water or coal was saved until they were made condensing engines. It is at once obvious that, with the locomotive, to turn a compound non-condensing into a compound condensing engine a difficult task is involved; yet I feel convinced that such an experiment, if conducted by those directly interested, would show such results as would be a surprise party to many coal-saving schemes.

Here on the N. P. Ry. we have many engineers who figure every way to save coal, and who show a favorable disposition towards our compounds, but who, as yet, have made only a slightly better average on the performance sheet with the compounds, as compared with the simple. For instance, there are men here who, with a simple Baldwin ten-wheeler, have made all the way from 35 to 43 miles per ton of coal and the average train (passenger) ten coaches. This record on a mountain division with as many cars will suffer but little when compared with either simple or compound engines running anywhere, I think. Big boilers, square engines and fine-tooth quadrants make great possibilities for any engine when handled with intelligence, without "laying off" on your neighbor when double-heading, too. We have men who, in heavy freight service with an 18 x 24 Baldwin eight-wheeler, have held their record between 30 and 40 miles per ton (oil mileage also being good); while, of course, the high-pressure compounds are heavy on oil—the latter evil being, however, hardly worthy of mention when we remember the cheapness of even good oil.

When we get compound condensing locomotives we will only be able to compare them with the non-condensing ones by the statement that the former are as light on coal with the injector on as the latter with it shut off. Any fireman, after his first trip, can appreciate this; at least we had one here that could. Our master mechanic, Mr. Clarkson, called in a new fireman who had not succeeded in much more than keeping her "warm." Mr. Clarkson asked "Ole" (he was Irish) what was the matter. "Ole" answered: "Aye keep him hot olrite, if enyaneer not put on inyector." Until recently we were of the opinion that there was more in the engineer and fireman in the saving of coal than the engine; but alas! results show that unless an engine is "just right," even the smartest men can only make a fair showing, and we have seen them at the bottom of the list. I have been waiting for some fellow to spring one of those 100-per-cent. coal-saving schemes on us, so I can "catch on"; but I guess they or he is in Cuba or the Klondike.

L. D. Shaffner.

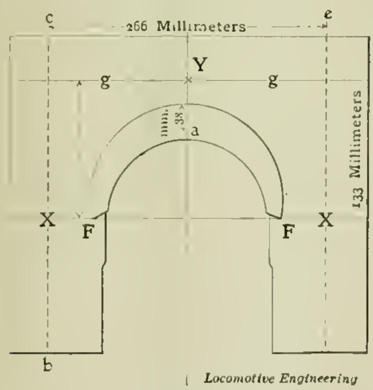
Hope, Idaho.

Simple Method for Boring Driving Box Brasses.

Editors:

In the August number of Locomotive Engineering, Mr. Fred Rogers shows a device for centering driving boxes which looks all right; but it is too much trouble to make the tool. Mr. Walter Gartside, the general foreman of the Interoceanico Railway shops in Pueblo, Mexico, has a plan I think much better. No stick with a piece of tin for a center is required. No special tool is used.

Mr. Gartside takes the box the stand-



BORING DRIVING BOX BRASSES.

ard for this road, 266 millimeters in size. From the outer edge of brass to the point *a*, the required thickness of the brass is 38 millimeters. One-half the diameter of the journal from the point *a* draw, square with shoe or wedge face of box, the line *F F*. The lines *b c* and *d e* are shoe and wedge faces. The points *x* on line *F F* are two points for lathe. Draw the line *g g* one-half size of box, from the line *F*: 133 millimeters from point *X* on line *F F* intersect line *g g* at *Y*. This is the third point for the lathe. The Mexicans do this work, and I have never seen any trouble from the above method.

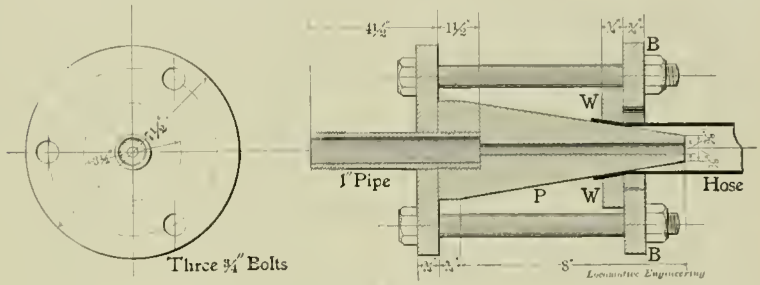
Fred Seltzer.

Pueblo, Mex.

A Handy Hose Holder.

Editors:

The illustration shows a very simple and thoroughly effective arrangement which was devised by Mr. C. H. Edson, foreman of the department of tests of the Baldwin Locomotive Works, to hold hose while subjecting it to water pressure for experimental purposes. Its simplicity is ap-



HANDY HOSE HOLDER.

parent on an examination of the figure, and since 1895, when it was first introduced into the Baldwin test room, it has fulfilled its purpose perfectly.

In the figure, *P* is a conical cast-iron plug, the taper surface being turned smooth to receive the hose. A hole ⅜ inch in diameter is drilled through the center of the plug to deliver the pressure water to the hose. At the back end the hole is enlarged and tapped out to receive a piece of pipe to make connection with the hydraulic main. To hold the hose, it is slipped on to the plug, through the holes in the back plate *B B* and the washer *W W*. The hole in the washer is turned out to the same taper as the plug to avoid cutting the hose.

The hose being in position, the back plate is pulled up by tightening the three bolts shown. This draws the washer up the plug and wedges the hose tightly between washer and plug, making so snug a joint that enough water pressure can be put into the hose to burst it, without leakage occurring at the joint.

To make the device useful for hose of any diameter between ⅞ inch and 3½ inches, a set of washers of different bores is provided. With the larger washers the back plate *B B* is discarded; the outside diameter of the washer is made 7½ inches; the bolts go through the washer and the nuts pull directly on the washer.

Before the advent of this contrivance, a very formidable array of clamps was needed for the testing of hose, and a great deal of time and trouble was expended in the securing of a good grip; while nowadays the preparation for a hose test is a matter of ease and minutes.

Lawford H. Fry.

Philadelphia, Pa.

Keying That Main Rod.

Editors:

There is one point in the discussion between yourselves and Orange Pound, in October Locomotive Engineering, in regard to keying rods, that does not seem to me to have been considered by either party.

Mr. Pound says the pressure is greatest on the pin when the engine is on the center, and consequently most wear occurs there. You make the same statement as regards the pressure, but that the wear comes later in the stroke, and that theory is unsatisfactory in this case. Now, as I see it, it is not theory, but the theorists that are at fault.

In the first place, the pressure on the piston and crank pin is not the same, except when the piston is at mid-stroke, or just as the engine starts; and, to be exact, not then, for there is always some friction between the piston and crank pin. It is only when an engine is standing that the pressure on the piston and crank pin is equal in any case.

When an engine is running, a part of the steam pressure is required to give the reciprocating parts the velocity to keep up to the crank pin, and the amount necessary to do this will depend on their weight, the steam distribution and the speed the engine is running. During the flight of the little Brooks ten-wheeler one autumn morning over the Lake Shore, several years ago, it would have required 250 pounds per square inch on the piston on the forward center to have balanced the inertia of the reciprocating parts. This assumes that the engines are 18 x 24 inches, the main rod 7 feet long, the speed 450 revolutions per minute, and the weight of reciprocating parts 800 pounds.

I feel safe in saying that on that memorable run, the wear on the crank pins, while going over the centers, must have been on the side of the pin next to the center of the axle.

J. H. Dunbar.

Youngstown, Ohio.

In the Navy.

Editors:

In my last communication I told you why and how I went into the navy. Like the author of "Railroading in the Confederacy" and "A Railroader in the Volunteer Army," we give our personal experience and tell what we saw. In the old navy there existed the rank of Third Assistant Engineer, who, while the ship was under way, had charge of the fire-room watch and the general condition of the fires, boilers, water, etc. Each Third Assistant, when coming on watch, would notice the hight of water in the boilers, condition of fires, etc., before relieving the watch. One of the duties of the Third Assistant was to test the water in the boilers, or, as they called it, "take the saturation." The word "saturation" means the quantity of salt in the water in the boilers. Now, what I am going to say does not relate to the rating of "oiler," but one of the things an oiler learns on shipboard. How salt is the water of the ocean? It varies in different localities. Along the Middle Atlantic coast it contains about 1 pound of salt in 32 pounds of water; but down about the Florida keys the impregnation is much stronger. But we will use the 1 to 32 as our basis. You will bear in mind that the steam of salt water is fresh; hence, as we use the steam in working the engines, we are extracting all or most of the freshness from the water in the boilers, therefore the water in the boilers would be getting away above 1-32, or sea-water density. Now the idea is, to keep the water in the boilers as fresh as possible, or not higher than sea-water density, and to avoid salting up. When the sea water is the principal supply for the boilers, the engineer in the fireroom must resort to pumping and blowing; that is, he must put on a strong feed, with a donkey-pump, and open either a bottom or surface blow. It has been maintained by some engineers that when the feed and blow are in force at the same time, there is a current formed between the two, and that very little change takes place. So when the condition of the sea is such as to allow it, the boiler is blown down two or three gages, and then filled up with fresh sea water. But this cannot be done in a heavy sea, on account of exposing the tubes to the action of the fire, by the rolling of the ship.

How do we measure the quantity of salt in the water? By the use of a hydrometer, thermometer and what is called a salinometer pot. You know "meter" means to measure; "thermo," heat; "hydro," the density of liquids; "saline" refers to salt. The salinometer pot is a brass vessel about 3 inches in diameter by about 12 inches long; it is connected to the water space of the boiler by a small pipe and stop cock. Sometimes the pot is located on the front of the boiler, again in the engine room. There is also an overflow pipe attached to the pot. Now, suppose we test the density of the water, or take the "saturation." We will first open the stop cock and allow water from the boiler to fill up the salinometer pot and to flow out the overflow pipe; this water is allowed to flow until the pot is well heated. If you don't know what a hydrometer looks like, get your Natural Philosophy and see a cut of one. Now you will notice that in the upper part of the tube there is a strip of paper with a graduated scale on it, and marked from zero down. We have our pot full of hot water, now hang a thermometer in the hot water, and when the temperature falls to 100 degrees put in the hydrometer; if the immersion brings the figure 2 (on the scale) on a level with the water, it shows that there are 2 pounds of salt in 32 pounds of water in the boiler, at a temperature of 100 degrees. If the line of immersion is at a higher figure, why, of course, the impregnation is stronger. The saturation is taken every hour by the engineer of the watch. While at anchor and under banked fires, the oiler on watch very often takes the saturation, while the engineer of the watch writes up the log.

Do I hear someone ask, What is the "log"? The log is a detailed statement of everything pertaining to the engine and fireroom. If under way, it comprises the number of revolutions of the engine; how wide open the throttle is; the point of cut-off; average steam pressure; temperature of engine and fireroom; temperature of sea water; temperature of hot well; inches of vacuum; buckets of coal used; buckets of ashes sent up; saturation of the boilers; which way the wind was blowing; if sail is carried, what sails were set; kind of weather; kind of sea; engines racing, or not—in fact, any and every thing that may have a bearing on the consumption of coal or working of the engines. All of these details are entered on the "log" slate in the engine room by the engineer of the watch. While at anchor and under banked fires, of course, a great deal is omitted; but all entries must be made every hour. The log is then entered in the log book by the best penman in the force. Indicator cards are taken by one of the engineers, assisted by an oiler; so you see the oiler is right-hand man to the engineer. A ship may be in China and her indicator cards sent to the Bureau of Steam Engineering at Washington, when the chief of the bureau can tell at a glance just what condition the engines of the cruiser —— are in. Well, I will belay this yarn for the present—but not to go out of commission.

W. DE SANNO.

Vallejo, Cal.

Adulterated Railway Supplies.

In the course of a paper on "Purchase and Inspection of Railway Supplies" by Mr. H. B. Hodges, purchasing agent of the Long Island Railroad, read at the New York Railroad Club, the following incident is related:

"A striking instance of the mistaken economy of buying cheap material was brought to my attention some years ago, when superintendent of tests of the Union Pacific Railway Company at Omaha. I had charge of the mechanical and chemical laboratories and of the inspection of rails, etc., at the mills, and the scope of the work done by myself and my assistants covered pretty nearly everything the road bought. Among the first problems we attacked in the chemical laboratory was that of paint, and among other samples analyzed was a chrome green in oil, used for tinting. The dry pigment, after it was separated from the oil, was found to contain only 10 per cent. of actual pigment—a mixture of chrome yellow and prussian blue—40 per cent. of whiting (prepared chalk) and 50 per cent. of barytes. This paint cost about 10 or 12 cents a pound. I advocated buying a chemically pure chrome green, which cost about 30 cents a pound. The purchasing agent was horrified at this recommendation, but I persuaded him that it was cheaper to pay three times as much for something which contained ten times the amount of coloring matter, and that a better covering and more durable paint could be obtained by diluting this pigment to the desired shade with white lead or zinc white than with barytes and chalk, and that if it was thought desirable to use the latter ingredients, it would be cheaper to buy them outright at a cent or two a pound, than to pay 10 or 12 cents a pound for them in the mixture we had been buying. While this was the most flagrant case of adulterated goods which ever came under my notice, it was by no means an isolated one."

Heavy Grades.

In the issue of April 24, 1852, of the *American Railroad Journal*, mention is made of a Ross Winans camel on the Baltimore & Ohio Railroad working up a grade of 520 feet to the mile.

This was but temporary, during the construction of a tunnel; but it comes pretty near being a record for grades with engines depending solely on adhesion for tractive power. The engine weighed 24 tons and hauled 12 tons up the grade.

There are no air-brake slack adjusters used in European railways, and it is the rule rather than the exception, to find flat wheels under the cars. Many cars carried by three pairs of wheels are used, and the middle pair never has brake shoes applied to them. The consequence is that the trains are underbraked as a whole; but as stopping has to be done quickly, the wheels that have brakes have to do more than a fair share of work, and there is always some wheel sliding at every stop. We believe the air-brake slack adjuster man would find a profitable field in Europe.

A Breeze & Kneeland Engine.

Many of our readers remember the old Breeze & Kneeland engines which were quite popular in many sections in the fifties and early sixties, and will probably recognize the "lines" of the Superior which is shown here.

This was built in 1853 for the Hudson River Road, and had 16 x 22-inch cylinders. The drivers were 7 feet in diameter and were wrought iron. It will be noticed that there were two steam domes, the whistle being on the front dome. The alleged safety valve will be remembered by the men of those days. The links were suspended from below, as shown, and the truck spring rests directly on the boxes.

We are indebted to Mr. Thos. S. Davis and to Mr. William G. Hamilton for the facts of the case, both gentlemen being formerly connected with the Breeze & Kneeland works when this engine was built.

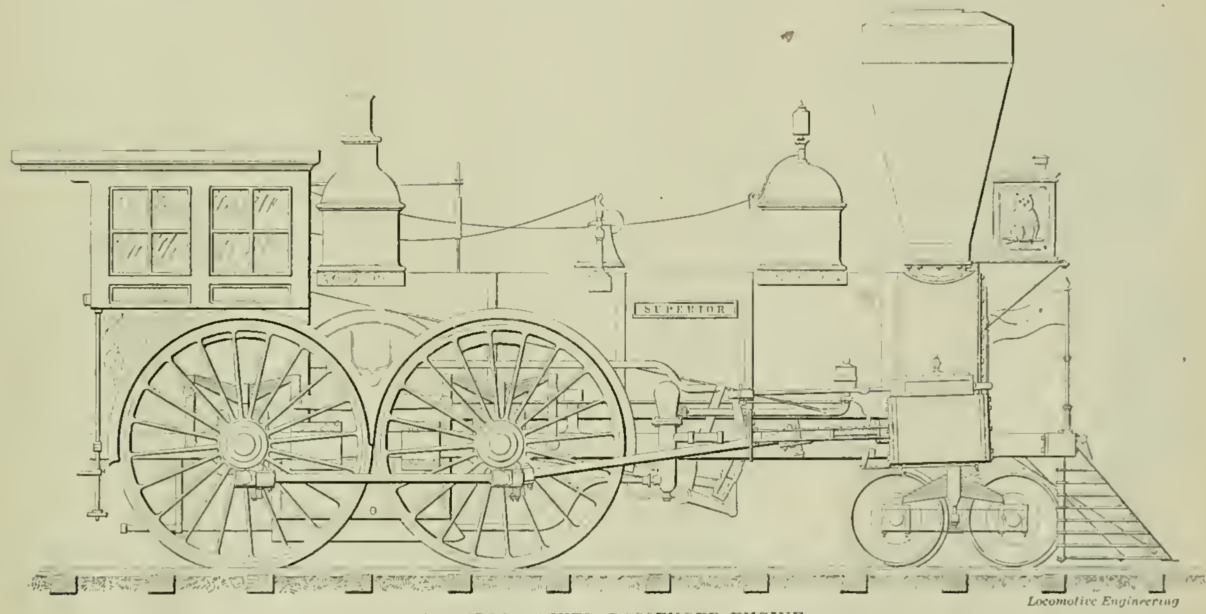
He Wanted a Rebate.

One day an old man entered one of the railroad depots in Detroit, and, walking up to the ticket office, he asked: "What you charge for dicket to Lansing?" "Two-sixty, sir," replied the agent, wetting his thumb and reaching out for the money. "Two dollar and zixty cent!" exclaimed the stranger, pulling his head out of the window. "Yes, sir, that is the regular fare." "Then I sthays here hy Detroit forty yare," said the man, getting red in the face. "I haf never seen such a schwindle as dot!" "Two-sixty is the fare, and you will have to pay it if you go," replied the agent. "I shust gif you two dollar und no more," said the stranger. "No, can't do it." "Vhell den, I sthays mit Detroit till I dies," growled the old man, and he went away and walked around the depot. He expected to be called back as he left the window, as a man is often called back to "take it along," when he has been chaffing with a clothing dealer. Such an event did not occur, and after a few minutes the old man returned and called out: "Vhell, I gif you two dollar and ten cent." "No, can't do it," replied the agent. "Vhell, den, I don't go, so help my grashus. I haf lived in Detroit three yare, und I shall bay bolice tax, zewer tax, und want to grow up mit dis town, and I shall not be schwindled!" He walked off again, looking back to see if the agent would not call him, and after a stroll round he returned to the window, threw down some money, and said: "Vhell, take two dollar und twenty cent, und gif me a dicket." "My dear sir, can't you understand that we have a schedule of prices here, and that I must go by it?" replied the agent. "Vhell, den, I sthays mit Detroit von tousand yare!" exclaimed the stranger, madder than ever. "I bay bolice taxes, und zewer taxes, und I shall see about dis by de Sheaf of Bolice!" He walked off again, and as he saw the locomotive backing up to couple on to the train, he went back to the window and said: "Gif me a dicket for two dollar und dirty cent, und I rides on de blatform." "Can't do it," said the agent. "Vhell, den, py golly, sphokes to you what I doze! Here is dem two dollar and zixty cent, und I goes to Lansing und never comes pack! No, zir, I shall never come pack, or I shall come mit der blank road! I bays taxes by dey bolice, und by dem zewers, und I shall show you dat I shall haf noddings mare to do mit dis town!"—and he went on the train.

The manager of a railroad running into Boston gave an order a few years ago to the flagmen of suburban trains to shout, when approaching the terminal station, "Boston, mind your packages." We notice that the practice is extending and has been introduced into some railroads running into New York. One of our friends, whose word is not so good as his bond, says that when suburban trains are approaching Philadelphia the brakemen call out: "Philadelphia, wake up and take your traps with you."

The new moguls put in service by General Master Mechanic Lyon on the Chicago Great Western, are fitted with underhung driving springs throughout. Placing the spring under the forward box instead of above it, gives a better idea of harmony in the arrangement when the main and rear springs are below, than to have the rig of the composite style usually affected on six-wheel connected engines, and this is further borne out by a cleaner-appearing equalization with the truck. The equalization of weight on the rails under the main and rear wheels is obtained by locating the fulcrum of the equalizer sufficiently away from the center line to produce the desired result, giving a long and short arm to the equalizer.

The trainmen of the New York, New Haven & Hartford system have been a little lax about using uniforms while on duty, and a circular has been issued by Mr. C. Peter Clark, general superintendent, intimating that rules concerning the wearing of uniforms must be strictly adhered to.



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What We Saw in Russia.

[EDITORIAL CORRESPONDENCE.]

For the last five or six years we have been hearing so much about the stupendous revival or advance of mechanical progress in Russia, that I was ambitious to observe on the ground the details of a movement which seemed unique in the development of the industrial arts. My studies of industrial progress in other countries had led me to believe that artisan skill had kept pace with the growth of education and intellectual force, and the accounts that had reached me of the spread of education in Russia did not justify the belief that the country had reached a position to compete with other nations in the production of articles which called for mechanical skill and constructive intelligence. After several unsuccessful attempts to get into the heart of Russia, so that I could judge for myself of the real condition of the industrial boom that America has been raving about, I found the way open this summer, and made the best of my opportunity for observation.

We went from Berlin by the Northern route, which took us through East Prussia towards the Baltic and northern borders of Germany and Russia. The country in Eastern Prussia was not alluring. Sombre pine woods that threw melancholy shadows over the landscape occasionally gave place to farms where untiring industry wrestled with the sterile sandy soil, and by hard toil forced out meagre crops, that the farmers of our most inhospitable lands would have abandoned after a season's disappointment. With all the obstacles to prosperity and decent livelihood encountered by these peasants, they nevertheless had the appearance of living in a condition above penury. Incessant toil seemed the lot of both sexes, almost from the cradle to the grave; yet they were clad in comfortable garments, housed in dwellings that would defend their inmates from the rigors of winter, and apparently supplied with the food needed to keep them in vigorous health.

When we passed the frontier into Russia the physical conditions of the country continued about the same, but the rewards for wrestling with the inhospitable soil seemed more meagre.

In all countries that I have ever traveled in, the railway station is a favorite lounging place at train time for people hankering after excitement, be it of the mildest kind. The roadside stations in Belgium, Germany or Russia give as fair specimens of humanity in the background as do the railway stations in the rural districts of New York, Iowa or Alabama.

The appearance of the people hanging about the station presents a fair reflection of the community they belong to. In Belgium, the young men, young women, boys and girls, who found leisure to greet the arrival of trains, were well clad and had ruddy cheeks that reflected wholesome food and fair sanitary conditions. As we proceeded westward in Germany the signs of poverty increased. Eastern Prussia was far from being a land of milk and honey; but the entrance into Russia led us among people whose tenor of existence seemed to be sustained by very hard endurance.

What I have seen of people in different parts of Europe leads me to think that boots form a good means of gaging the condition of the working classes, especially in cold countries. When you see the majority of the people who do the real work of tilling, spinning, smithing and mining, poorly clad and badly shod, you may be sure that the country they belong to is not in a prosperous condition. As far as we went, the peasants in Russia were poorly clad, poorly shod, and their appearance indicated that they did not eat enough nutritious food.

Remarks about the condition of the masses of the people and their supply of material for an industrial population, I shall leave to a future article. In the meantime, I shall tell something of what we saw at the end of the journey and describe some of the impressions received.

In St. Petersburg we did not hear much about the great industrial revival, although we thought that we detected some of the wires that led orders for machinery towards America. We visited several engineering establishments and were wonderfully well received by the officials in charge. They received us as friends, and were immediately embarrassing with their hospitality.

Among the members of the American colony that we met in St. Petersburg was Mr. Gordon, representative of the Baldwin Locomotive Works, who seemed to know all Russian officials, from the Emperor downwards, and who introduced us to princes as if their blood was no thicker than that of the "mujik," who is the cabman of Russia and the roughest of his class. Of course we were, as true Americans, gratified at hob-nobbing with real aristocratic people, and almost excused Mr. Hitchcock, the American minister, the snobbishness of posing with barbaric splendor, at the coronation of the Tzar, in a suit specially designed by one of his flunkies. All previous American ministers had held to the dignity of plain evening clothes.

While the people in St. Petersburg are ready to expatiate on what Russia is going to do in the line of ordering machinery from America, we must go to Moscow to learn facts about what tools have been ordered, and the immediate prospects of requisitions going in for others. Its central geographical position naturally makes Moscow a depot for machinery that has to be distributed all over the empire. The United States has been particularly fortunate in having a consul in Moscow who is remarkably intimate with all the needs of the country for machinery that must be supplied from abroad. Mr. Smith, our Consul, is an encyclopedia of Russian needs in the machine line, and by some means he contrives to keep the doors of the market open for his countrymen, while he does not forget to let them know where the opportunities are located.

Mr. Walter F. Dixon, manager of the Sormovo Locomotive Works, met us at Moscow, and made our way smooth to his residence within the establishment and into the presence of his charming Russian wife. Sormovo will not be found on the map, but Nijni-Novgorod will point the location, as the places are close neighbors. When we have been there and seen what there was and studied the location, we are puzzled to account for a great locomotive-building establishment being built at that place. From the American standpoint, it has no recommendation or natural advantages for the locating of a mechanical industry. There is no raw material in the neighborhood, there is no supply of skilled labor within many miles, and the place is not convenient as a distributing point. It is on the Volga River, which is far-reaching in its tentacles, and rakes a wide extent of territory downwards to the Caspian Sea and upwards through many small streams. Nijni-Novgorod is near the head of steamboat navigation, and has for centuries been a celebrated entrepot for the exchange of merchandise between Europe and Asia, and no doubt on that account a general engineering establishment was built at Sormovo years ago. Although it is a very poor place for obtaining the material from which locomotives are made, or for delivering the locomotives after they are built, there is no doubt that the bureaucracy which rules Russia concluded that a point which had a great annual fair, where the products of the West and East were exchanged, would be a good place from which to start out locomotives on their first journey.

I have met people in America who envied Mr. Dixon when he obtained the appointment to be manager of these works. That arose from blissful ignorance of the difficulties to be overcome and the obstacles to be broken through in building, equipping and putting in operation works for producing refined mechanical machines, in a region where handicraft skill was scarcely to be found. In the midst of tribulation, whose intensity can only be imagined by those who have labored in mud and fierce, frozen gales to get a new shop going, without the aid of skillful help, the shops were forced into running order, and at the time we were there had finished six locomotives and about thirty boilers. The orders received seemed sufficient to keep the shops busy for many years. Their capacity is about 100 engines a year, an output that will be quickly absorbed by the Russian railways now operating trains, to say nothing of the needs of the Great Siberian Railway.

I learn from a letter received from Mr. Dixon since this letter was in type, that the works turned out seven locomotives last month; so they must be getting into good running order.

The shops are very well arranged on the best American models, and have probably the finest selection of machine tools ever put into a locomotive-building establishment. They are practically all American, and the best that our makers turn out.

The locomotives built under the first large order are all two-cylinder compounds, with outside cylinders, and power about equal to our 20 x 24 inch engines. The cylinders are 19½ x 20 inches, with 25½ inch stroke; high-pressure ports 14¼ inches, and low-pressure ports 19½ inches long. From an American standpoint the engines are extremely ungainly, with a multitude of attachments stuck on in a fashion that outrages our taste for artistic effect. The cylinders display many pipes that I could not understand the purpose of. The apparatus for operating the cylinder cocks is a very elaborate affair, and costs more than our reverse levers. They have all plate frames, 36 x 1 5-16 inches, that are in high favor with Mr. Dixon and the other engineers, and they no doubt have merits which I was unable to appreciate.

One feature about the engines that seems above criticism is the boilers. They are splendidly designed and constructed with infinite care. All the holes in the boiler sheets are drilled under machines made by William Sellers & Co., which secures perfect work. Little reaming is necessary, but the riveting is done in a thoroughly workmanship manner. Iron tubes are used with copper ends; but they stick to the European practice of making the fireboxes of copper. The staybolts are of copper, set 3½ and 3⅞ inches apart. Holes are drilled in all the staybolts to detect fracture, even in the portions covered by the frames.

Although the present capacity of the works is comparatively small, the facilities for doing work may be greatly expanded, for the buildings are put up on a very liberal scale. The machine and erecting shop is 600 x 113 feet; the wheel shop, 240 x 120 feet; the boiler shop, 270 x 120 feet, and the blacksmith shop, 320 x 110 feet. The latter shop is one of the best of its kind I have ever seen. The castings are obtained from the old works, and they are remarkably good in every respect. It is surprising to find the foundry turn out the castings they do, for the place does not prepare a visitor to expect a perfect output.

The Russian designers appear to make careful provision against bearings running hot, and they provide liberal bearing surfaces that some of our own designers might imitate to advantage. The driving axle boxes seem to be objects of supreme solicitude. They are all made of brass, with liners on each side made to fit pedestal on face and sides. Cross channels are cut for holding the oil. There are two lids on top, with leather liners to keep them tight. On the cellar are cast two lugs, 2½ inches apart, which are drilled for a bolt that passes through heads of two bolts that go through cellar and side of box. That makes a good, secure job, and the cellar is easily taken down.

All the engines have extended piston rods, copper steam pipes and copper receivers. To us the main rods, side rods and valve connecting rods seemed light, but all European locomotives have this peculiarity. The valve motion applied to all the locomotives is Joy's, modified to suit the ideas of the designers. All the motion is outside and easily got at, which is a good feature.

The works appear to be operated as well as circumstances will permit; but the circumstances are not entirely satisfactory from an American standpoint. As we were entering the main part of the works, we observed a group of workmen sitting on the grass, talking and smoking. We asked Dixon if he considered that permissible, and he shrugged his shoulders and remarked, "It would not be, if I could help it; but an attempt to stop it would result in all the men in the shop walking out." The workmen are overgrown children, whose business ideas have been stunted by conditions similar to those that existed in the South before the war, and they must still be treated as beings beneath the ordinary practices of personal responsibility.

In the machine shop there is a Sellers tool-grinding machine. In America one man can operate that machine to grind all the tools needed in a bigger establishment than that of Sormovo; but here we found three men wrestling with the operating of the machine.

The use of compressed air is thoroughly utilized in these works, and this medium of transmitting power is probably here employed to greater advantage than in any engineering establishment in Europe. There is a compound Rand air compressor, which supplies compressed air to a great variety of appliances. They make good use of a great many tools supplied by the Chicago Pneumatic Tool Company, and Mr. Dixon talked quite enthusiastically about the help he had received from these apparatus. There is no end of lifts operated by compressed air, even the doors of furnaces being lifted by this means.

Oil is used for all the heating furnaces, and the boilers obtain heat from the same source.

The Sturtevant system of heating is employed in most of the shops, and it is entirely satisfactory for keeping the buildings comfortable in the severe climate of this region. An engineer who went about with us remarked that the heating system was the best paying novelty about the place, for it enabled the men to work steadily without wasting half of their time slapping the numbness out of their hands.

All the machines liable to be operated intermittently are worked by electric motors.

Russia is supposed to be an absolute despotism ruled by the Tzar, but in reality it is ruled by a crowd of permanent officials, mostly military. These officials are enamored on forms. Red-tape practices never reached maturity until they found an abiding place in Russia.

The formalities that must be gone through before a man can be taken on in an establishment like the Sormovo Works give a good illustration of red-tape methods. When a man applies for employment, he has to bring his passport to show what place and class he belongs to. There are about ten classes above that of mujik, which is peasant, and is really the foundation of all the Russian people. If the foreman wants the applicant, he certifies what kind of work the applicant will be employed upon and the rate of pay. The passport is then sent to the public office for substantiation. If all particulars are correct, the passport comes back, and the man is authorized to go to a doctor for physical examination. If he goes through that ordeal satisfactorily, the passport is sent to the manager of the works, and if he countersigns it the foreman is at liberty to employ the man.

It goes without saying, that an inelastic system of this character paralyzes business when foremen are pushed with work and are suffering for want of workmen.

A. S.

Improving on the Brown System.

There is a peculiarity about the American mind that makes it very difficult for one man to accept the inventions of another without adding some supposed improvement. This has led to the diversity in machinery details which is very expensive in practice, although the tendency has its redeeming points in cultivating the national inventive ability.

We were surprised the other day to encounter a newspaper article with the caption, "Brown System Demolished; Goodyear Tells Railway Men to Get Something New." The article referred to a paper read by Mr. J. H. Goodyear before the Northwestern Railway Club, on "The Disciplining of Engine and Train Men." We now have the full text of the paper before us, and find that it makes no attack on the "Brown System of Discipline Without Suspension," but shows up the evil results that have come from the establishing of modified editions of the Brown system. It is the old story of men not being able to accept the invention of others without trying to improve upon it. The improvement made on the Brown system by the officials of one or more roads running out of St. Paul made its working so tyrannical that the men affected were much better off under the old system, where a train master or superintendent might inflict a long suspension for a trifling violation of discipline.

The genius of the Brown system is to do justice between a railroad company and its employés. It does not strain out the inclination to inflict punishment. It recognizes that adherence to rules is necessary, and that those who violate the rules for the safe and prompt movement of trains should be disciplined for the benefit of themselves and for the good of the service. But the man is not suspended from duty or fined. Certain marks are put against his record; but good behavior for one year cancels a certain number of the marks recorded against him, and continued good behavior obliterates the record of whatever fault he may have committed either through carelessness or lack of judgment. A clear record for one year with nothing previous against him, entitles a man to a cash premium.

In raising objections to the Brown system pure and simple, Mr. Goodyear says: "In an article explaining his system, Mr. Brown, among other arguments in favor of disciplining without suspension, says: 'We are very careful in the selection of our men, promote all our own engineers and conductors, and in a few months or a year or two our record tells us whether they are adapted for the business or not. We have engineers who have been running here more than twenty-five years without a scratch of the pen against them; while others, who have been running as many months, have quite a page of irregular circumstances; but down near the bottom of such a page can generally be found the words, "Discharged; incompetent."'

"If by such a statement Mr. Brown intends to convey the impression that his system can be made the means whereby, by comparing the record of the man with twenty-five years' service with that of the man with twenty-five months', the fitness of the short-service man can be decided, I want to say in my opinion such a comparison is not a fair one. Any man who has spent twenty or twenty-five years in the service of one road either as engine or train man must of necessity have a passenger or preference run. We all know that while the responsibility attached to such work is as great as that attached to any other class of work, the liability to get into trouble is reduced to a minimum, for the reason that everyone, from the section hand up, endeavors to make things run smooth for that class of service; consequently, men thus employed can, with ordinary care, steer clear of trouble. Again, we must not ignore the fact that, in all probability, the greater part of the old man's time was served prior to the adoption of the Brown system.

"On the other hand, the new man on the extra list, handling way freight or inferior class of trains, has everything to contend with. Unless exceptionally lucky, demerit marks accumulate at such a rate that before he has been with the company three years the question of his fitness will be raised, and in the majority of cases, his services dispensed with at a time when he is beginning to be of value to himself and employers. He then becomes a tramp—but I want to say from necessity, not choice. Another bad feature as between the old and young men is this: The old men do not often get demerit marks; but when they do, the fact sticks very much in their throat, and their grievance is well ventilated before the younger men, who already have troubles of their own in the form of demerit marks rapidly accumulating, and are therefore good material out of which to make discontented and unsettled men."

There is a basis of reason in those contentions; but the method adopted for making the system adapted to roads where many extra engineers are employed was about as unjust as anything that could be conceived. The Brown system as far as it dealt with marks against a man, was adopted, but the real redeeming feature that gives credit for good behavior was entirely omitted. It suited the road to dispense with suspension, because the loss of a man's services was often embarrassing; but they kept heaping up discredits for every trifling offense, until a time came when a really good and valuable man knew that he had to resign or be dismissed pretty soon. An investigation brought out the fact that the enginemen preferred the suspension system to that in use; but they were nearly all favorable to the debit and credit system if it was carried out fairly. Unless the employés of a railroad company feel that they are likely to be fairly treated, even when misfortune brings them within the lash of discipline, there is going to be demoralization all round, and the company will suffer from the effects of indifference to their interests. Officials who adopt a system which causes continual change of their enginemen, punish their company more than they punish the men.

Ought Mechanics to Supervise Repair Shops?

The Northwest Railway Club, at the September meeting, had under discussion the proposal to consolidate the Master Car Builders' and Master Mechanics' Associations. The consensus of opinion expressed was against the proposed consolidation, but these opinions were not so important as some utterances of Mr. Tracy Lyon on a subject in which all railroad men are keenly interested. Mr. Lyon said:

"Mr. Goodyear says in his paper that unless active steps are taken, in a few years the absolute control of engine, roundhouse and car men will be in the hands of train superintendents. That is something I should be rather glad to see. A railroad is not operated for the privilege of inspecting cars or operating roundhouses. The purpose of a railroad is to move freight and passengers. The other things are simply the tools to this end, and they should be handled as such. I myself believe that before very long the strictly operating part of a railroad, including the control of engine, roundhouse and car men, will be more entirely in the hands of the superintendent, and that the function of the mechanical man will be more in the way of a consulting engineer, as it were. As it is now, he is retained practically by the railroad as an expert, yet he has, as such, too much to do with the actual traffic of the railroad. He might accomplish more if he had more leisure to consider quietly the larger problems of the improvement in cars, motive power, fuel handling and consumption, machinery and everything that pertains to the maintenance and operation in itself of the rolling stock and the great shops of a railway.

"One of the most important factors in the economical operation of a railway today is the obtaining of the most powerful engines and cars of the greatest capacity at the least expense of dead load, not to mention the development of such coupling apparatus and brakes as will permit the longest trains to be safely and expeditiously handled."

We perfectly agree with the sentiment that the purpose of a railroad is to move freight and passengers, but at the same time good business methods ought to be pursued in the construction, maintenance and repair of the equipment necessary to carry on this business of hauling freight and passengers. All that we have seen and known of railroad operating leads us to believe that the change in the management of the mechanical departments, advocated by Mr. Lyon, would exercise a pernicious effect upon railroad interests and on the men who are now under the charge of mechanical officials. The change would put all repair shops under the charge of men who are ignorant of the work to be done. It has always been the policy of successful business enterprises to employ the best and most skilful supervision that could be hired, and the abler the men in charge the more liberal, as a rule, are the returns on the capital invested. Railroad companies have managed to exist under very inferior supervision at times, but we do not think there are many railroad managers who would deliberately put men in charge of shops who had not received training that would enable them to judge if the work was properly and economically performed.

In fact, we believe that the tendency is in the other direction, to require increased skill, knowledge and experience on the part of those who have charge of shop operations. A railroad president once consulted with the writer in the selection of a man for the mechanical head of a great railroad, and the requirement that he insisted on most emphatically was that the acceptable man should be able to visit repair shops and tell of his own judgment if the work was being properly and economically done. That was a common-sense view to take of the matter. A tailor might be found who could manage a printing establishment successfully, but owners of such places prefer a practical printer. There is no mystic air about a railroad shop which will dispense with skill and knowledge, any more than there is in any other shop, and any company that permits ignorance to supervise such a place will pay for adopting bad business methods.

Breakage of Piston Rods.

We have frequently heard engineers say that when any member of a machine was in the habit of breaking, it was too weak and ought to be made stronger. That is a fairly safe rule to follow, but there are cases where it does not hold good. There are certain parts of locomotives and other steam engines, that are given to breaking, and increasing the size with the view of making them stronger does not prevent the breakage, but seems rather to increase the number of accidents. The most conspicuous example is in the continued breakage of piston rods. It is easy to figure out the magnitude of the stresses that a piston rod must endure and the amount of metal that ought to safely resist the stresses. Big margins of safety have been allowed, and yet the theoretically strong piston rods continue to break, not only in America, but in every country where high-speed engines are employed.

At the last meeting of the American Society of Mechanical Engineers, there was a discussion on the breaking of piston rods that brought out some facts which deserve the attention of steam engine and locomotive designers.

Professor Sweet, the well-known mechanical engineer and expert, who seldom speaks on a mechanical subject without shedding new light upon it, made some interesting remarks about the breaking of pistons. The proposal had been made to use steel of higher degree of hardness than that usually employed, and Professor Sweet said: "I think the story cannot be too often told, that there are certain cases where the high steel does better than the soft steel. There is another way to get over the same difficulty mechanically. Everyone who makes a good hammer handle whittles it down small between where the hand takes hold of the handle and the hammer. He does not do it to save wood, but he does it to add to the life of the handle. A bright genius some thirty years ago discovered that where axles were breaking near the wheel he could increase the life of the axle and also save the metal if he brought it down in the center. My brother discovered that piston rods were breaking where they entered the hammer heads of his steam hammers. He scooped out that part of the piston rod between where the packing came and the hammer head, and increased the life of the piston rod 300 per cent. I would suggest the same in this case. If you scoop it out for as long a distance as can be spared, you have always got the depth of the gland; you will add to the life of the rod. Or, to put it in a form that you will remember, you will make it stronger by making it weaker. Whether a round groove is the best way, or whether it is better to reduce it straight with a round-nose tool, mathematicians can tell you better than I can. Manufacturers cannot do either. If they did, they could not sell the engines. But the man who buys them can take his rods and turn them down, and he will increase their life immensely."

We commend these remarks to the attention of locomotive designers and to the master mechanics who are daily having new piston rods forged to take the place of those that have broken and permitted the piston to go through the cylinder head. We understand that there has been trouble among our torpedo boats with piston rods breaking. The engines of these vessels receive almost as hard usage as a locomotive, and the trouble common to one is well known on the other. Our naval engineers ought also to try the effect of weakening piston rods to make them stronger.

We have been favored with a copy of Part 13 of J. G. A. Meyers' "Easy Lessons in Mechanical Drawing and Machine Design," and far from being unlucky, it is one of the most interesting of them all. In mechanical drawing, it shows the laying out of sheets for wagon-top boilers and similar work. As usual, these are plainly and clearly shown, so that anyone can follow the directions. The practical rules and useful data comprise the strength of beams of different sections, strength of I-beams, moment of inertia applied to computing the strength of beams; table of moments of inertia for different sections and for I-beams and graphical determination of bending moments. It is a fine beginning for Volume II, and those interested should apply to Arnold Publishing House, 16 Thomas street, New York.

The Baltimore & Ohio Southwestern Railroad has just received from the Baldwin Locomotive Works ten new freight locomotives, for use on the Ohio division from Cincinnati to Parkersburg. This portion of the road has some rather heavy grades, and these are the first heavy engines to be used on the line. It is expected they will increase the train haul about 40 per cent. The simple locomotives have 21 x 28-inch cylinders, and the compound 15½ and 26 x 28-inch cylinders. The locomotives were built from designs furnished by Superintendent of Motive Power Neuffer. Eight are simple and two are compound.

The report of the thirty-second annual convention of the Master Car Builders' Association, just received, is an unusually large volume, having 452 pages, besides a large number of folded sheets containing engravings and tables. In addition to the proceedings of the annual convention, the report contains the text of all the decisions of the Arbitration Committee made during the past year, the Rules of Interchange of Cars, the Standards of the Association, and much other useful information. The report can be obtained from the Secretary, Mr. John W. Cloud, Rookery, Chicago.

The Safety Appliance Company, Ltd., Boston, are equipping all the coaches and baggage cars of the Dayton & Union Railroad Company, Dayton, O., with their brake equalizer and dead lever take-up, and during the past month they have received orders to equip over 900 cars.

PERSONAL.

Mr. Harry Wilbur has been appointed division engineer on the Lehigh Valley, with office at Easton, Pa.

Mr. W. T. McCulloch has been appointed general manager of the Norfolk, Virginia Beach & Southern. Office at Norfolk, Va.

Mr. A. D. Hart has been appointed superintendent of the Manistee & Grand Rapids at Manisteee, Mich., vice Mr. W. H. Herbert, resigned.

John M. Forbes, Sr., president of the board of directors of the Chicago, Burlington & Quincy Railroad, died at his home, in Milton, Mass.

William B. Snow, for many years prior to 1891 master mechanic of the Illinois Central, died last month at his residence in Chicago, at the age of 78.

Mr. E. D. Jameson has been appointed assistant master mechanic of the Western division of the Grand Trunk Railway. Office at Battle Creek, Mich.

Mr. J. W. Platten has been appointed assistant purchasing agent of the New York, Susquehanna & Western. Office, 21 Cortlandt street, New York.

Mr. H. A. Dewey, superintendent of locomotive service of the Chicago & Eastern Illinois, at Danville, Ill., has resigned to engage in other business.

Mr. Alfred Lovell has been appointed assistant superintendent of motive power of the Northern Pacific, with office at St. Paul, Minn. He was formerly engineer of tests.

Mr. O. W. Taylor, train dispatcher of the Southern Pacific lines in Oregon, has been appointed assistant to Mr. L. R. Fields, general superintendent at Portland, Ore.

Mr. L. H. Albens, formerly air-brake inspector on the Cincinnati Southern, has been appointed air-brake instructor on the Lake Erie & Western. Headquarters at Lima, O.

Mr. W. I. Cooke has been appointed superintendent of locomotive service of the Chicago & Eastern Illinois, vice Mr. H. A. Dewey, resigned. Headquarters at Danville, Ill.

Mr. A. S. Work has been appointed traveling engineer of the Wabash, with headquarters at Moberly, Mo. He was formerly traveling engineer of the New York, Chicago & St. Louis.

Mr. C. A. Delaney, formerly superintendent of the Richmond Locomotive & Machine Works, Richmond, Va., has been appointed superintendent of the Dickson Locomotive Works, Scranton, Pa.

Mr. B. C. Gesner, an engineer on the Intercolonial Railway of Canada, has been promoted to the position of general air brake inspector of the entire system, with headquarters at Moncton, N. B.

Mr. M. F. Bonzano has resigned as superintendent and chief engineer of the Columbus, Sandusky & Hocking, to return to his old position as general manager of the Chattanooga Southern, at Chattanooga, Tenn.

Mr. B. S. Snyder, foreman of the New York, Chicago & St. Louis roundhouse at Conneaut, O., has been appointed master mechanic of the Columbus, Sandusky & Hocking at Columbus, O., vice Mr. T. M. Downing, resigned.

Mr. G. H. Kimball has been appointed general superintendent and chief engineer of the Columbus, Sandusky & Hocking with headquarters at Columbus, vice Mr. M. F. Bonzano, resigned. He was formerly connected with the New York, Chicago & St. Louis.

Mr. J. J. Donovan, vice-president and general superintendent of the Bellingham Bay & Eastern, has been given the additional duties of general superintendent of the Bellingham Bay & British Columbia, with office at New Whatcom, Wash., vice Mr. C. L. Anderson.

Mr. J. S. Chambers has been appointed superintendent of motive power of the West Virginia Central & Pittsburg, with headquarters at Elkins, W. Va. He succeeds Mr. J. S. Turner, resigned. Mr. Chambers was formerly master mechanic of the Illinois Central, at Paducah, Ky.

Mr. D. P. Kellogg, general foreman of the Duluth & Iron Range, at Two Harbors, Minn., has resigned to take charge of the air equipment and trucks on coaches in the shops of the Southern Pacific at Oakland, Cal. Mr. Kellogg is an old friend of LOCOMOTIVE ENGINEERING and has contributed several articles to its columns.

Mr. George H. Campbell, terminal agent of the Baltimore & Ohio Railroad at Baltimore, has, in addition to his present duties, been appointed inspector of stations and terminals over the whole line, reporting to the general superintendents in their respective territory. Mr. Campbell has long been noted for his ability in this direction and the object of the appointment is to secure at each terminal better service in every respect, and is in line with the policy of the receivers to give to the patrons of the road better and quicker facilities for the handling of freight.

Mr. F. M. Stevens, who has been for some years general foreman of the locomotive works at Sormovo, in Russia, has accepted a position with the Baldwin Locomotive Works, and has gone to Vladivostock, Russia. He went overland in company with his wife, some five or six thousand miles, a great part of the distance having been traversed in a kind of Russian carriage called a tantrass, a sort of springless wagon that makes a long journey extremely fatiguing. They do not have springs because the roads are so bad that no springs could be kept whole. Mr. Stevens was formerly with the Baldwin Locomotive Works in Philadelphia, and is a brother of George W. Stevens of the Lake Shore.

Royal Cheney.

One of the oldest, if not the oldest engineers in active service in the country died in Worcester, Mass., on September 1st. Every railroad man in Worcester knew Royal Cheney, who had been with the Boston & Maine Railroad since 1851. He was overcome with heat, fell out of the cab and under the wheels of switcher No. 344, which he was running at the time.

In his long term of railroad service he had few accidents, it being a sort of modest boast that he never had to jump from his engine.

Mr. Cheney was a charter member of the Worcester division, No. 64, and was

ROYAL CHENEY.

a delegate to the Baltimore "Convention of the Footboard," held in 1864.

The writer did not know him personally, but has seen him many times, and no one could be around Worcester railroad men without hearing the praises of Royal Cheney.

Frank F. Hemenway.

Among the eminent men who passed away last month was Frank F. Hemenway, who has been an occasional contributor to LOCOMOTIVE ENGINEERING, and was one of the most accomplished steam engineers in the United States. Mr Hemenway was born at Hartford, N. Y., in 1837, and served a regular apprenticeship as machinist at Keene, N. H. He joined the army at the beginning of the Civil War and served throughout. After the war he went to work in the Troy & Boston Railroad shops, and was there closely associated with George W. Richardson in perfecting the pop safety valve and the Richardson balanced valve. He was afterwards for a time foreman of a large machine shop in Troy, which he left to supervise the manufacture of an engine of his own design.

He interested himself very keenly in engineering literature, and about twenty years ago began contributing articles to the *American Machinist*. His writings were so much appreciated by the readers of that paper that he was engaged as an assistant editor, and subsequently rose to be chief editor of the paper. He is the author of a well-known book on the indicator and the "Catechism of the Steam Plant," which we have just published. As a writer of clear, terse English, Mr. Hemenway had few equals. His power of description was so vivid that no reader ever needs to read a sentence twice in order to understand it.

Mr. Hemenway was one of those helpful men that others naturally turn to when needing assistance, and from him it never was asked in vain. His big, warm heart was always sympathizing with the weak and doing battle against all forms of meanness and injustice. The battle of life, however, went against him. He had three children who died one by one until none remained. He did not bear the affliction well, and his later years were of the most melancholy kind.

EQUIPMENT NOTES.

Manchester Locomotive Works are at work on six for the Boston & Maine.

Union Car Company are building 200 freight cars for the Fitchburg Railroad.

Wells & French are building eighty-two freight cars for the Southern Pacific.

H. K. Porter & Co. have a small engine for the Apollo Iron & Steel Company.

J. Hammond & Co. have twelve freight cars for the Sierra Railway Company, of Colorado.

Missouri Car & Foundry Company have 100 cars for the St. Louis Refrigerating Company.

Pullman Palace Car Company have thirty freight cars for the Pecos Railway & Land Company.

Ohio Falls Company are building 100 freight cars for the Columbus, Sandusky & Hocking Valley.

Dickson Locomotive Works have ten of the consolidations for the Atchison, Topeka & Santa Fé.

St. Charles Car Company are at work on twenty freight cars for the United Verd & Pacific Company.

Michigan Peninsular Car Company also have 250 freight cars for the Columbus, Hocking Valley & Toledo.

Russel Wheel & Foundry Company have twenty-five freight cars for the Chippewa River & Menomonie.

Brooks Locomotive Works are building eleven heavy engines for the Buffalo, Rochester & Pittsburg Railroad

The Ensign Manufacturing Company have 200 freight cars for the Columbia, Hocking Valley & Toledo, and 100 cars for the Norfolk & Southern.

Richmond Locomotive Works have under way seventeen moguls for the Finland State Railway, six engines for the Plant System, one consolidation for the Chesapeake & Ohio.

Schenectady Locomotive Works are building one locomotive for the Miike Mine, Japan; seven with eight coupled wheels for the Northern Pacific; two eight-wheel locomotives for the Florida East Coast.

Baldwin Locomotive Works have four consolidations for the Fitchburg Railroad, two consolidations for the Bridgeton & St. Andrews Railway, two for the Chicago, St. Paul, Minneapolis & Omaha Railroad; a tank engine with six drivers for the Wiggins Ferry Company; two for the Southern Railway; five for the Chicago, Milwaukee & St. Paul; twenty-five consolidations for the Atchison, Topeka & Santa Fé; ten for Norfolk & Western.

WHAT YOU WANT TO KNOW.

Questions and Answers.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(79) L. Y., Marion, O., writes:

Why does the middle of Laird guides wear faster than the ends? A.—Because the main rod transmits the greatest pressure upon the guides when the crosshead is in the middle of its travel.

(80) W. A. R., Rock Island, Ia., writes:

How many hours of one man's work are expended in building an ordinary locomotive? A.—About 17,000 hours in America, 24,000 hours in Great Britain and 28,000 hours in Russia.

(81) J. S. W., Toledo, Ohio, asks:

What effect would salt have on a hot crank pin? A.—We have never had any personal experience with salt on a hot pin, and cannot therefore give an authoritative answer to the question; but those to whom we have referred the question say that the effect is to reduce the temperature.

(82) W. E. S., Fremont, Neb., writes:

Will an engine draw smoke and cinders from the smoke arch in the steam chest and cylinder when running down grade with the throttle closed and reverse lever in the forward notch? A.—Yes. The suction that draws air through the nozzles is very slight when an engine is running with reverse lever in full gear, but there is always some action of that kind. When running notched up the action is very decided.

(83) O. C. S., St. Paul, Minn., writes:

Please let me know what mixture makes a good-looking front end and boiler head. A.—Boiled linseed oil, darkened with a little lamp-black, makes as good a composition as anything we know about. We have used tallow, darkened with lamp black, with good advantage for the same purpose. There is a tendency among many firemen at present to use plumbago as a polish for smokebox and boiler head. It stands the heat very well, but, in our opinion, does not make a handsome finish.

(84) C. F. C., Estherville, Ia., asks:

1. What is the ratio of steam pressure to cold-water pressure? A.—1. We do not exactly comprehend the import of this question; if the facts sought are stated, we may be able to answer. 2. About what is the limit of steam pressure at which lubrication can be maintained with any degree of economy with valve oil of average quality? A.—2. Sibley's "Perfection" valve oil will withstand a temperature of over 500 degrees Fahr. before vaporizing, and will therefore perform its office of lubrication at any steam pressure having a temperature less than the above—say, for example, 500 pounds per square inch, which pressure has a temperature of 444 o degrees Fahr.

(85) I. S. W., Wilkesbarre, Pa., writes:

1. How do you find out the length of piston when the guides are not up on new work? A.—1. The drawings show the proper length of piston rod. 2. How do you ascertain the length of main rod? A.—2. From the drawings. 3. What is the best way to square an engine? A.—3. If you mean the valves, the best way is to put the driving wheels on rollers and adjust the valves in the usual way. Full particulars of how to do that will be found in Sinclair's "Locomotive Engine Running and Management." 4. Why is one rocker arm sometimes made longer than the other? A.—4. This is done in connection with the locating of the rocker, which is put close to the top of frame. The upper arm is then made long enough to move the valve rod horizontally.

(86) W. H. S., Salt Lake City, Utah, writes:

Please inform me what percentage of balance can be used successfully on the slide valves of locomotives, and the rule for calculating the same. A.—A committee of the Master Mechanics' Association, in view of the uncertainty and general lack of reliable data on the subject of balancing valves, made some original tests with the locomotive at Purdue University in 1896. In these experiments it was found that about 62 per cent of the total valve area could be relieved of pressure without danger of lifting from the action of the pressures in the ports. The results obtained led to the recommendation of the following rule for balancing valves, both of the Allen and plain types. Area to be balanced equals area of exhaust port plus area of two bridges plus area of one steam port

The Olwein Shops.

The Chicago Great Western Railway has well under way at Olwein, Iowa, a shop plant which, for the purposes of railroad work, is said to outrival the best thus far built, in all of the up-to-date appliances for doing work cheaply and well. Unlike many other new shops that have been supplied with old, broken-down tools, this one will be equipped new, and there will not be an old tool in it. Master Mechanic Lyon is authority for the above, and is very enthusiastic over his creation.

Electricity will play a larger part in this plant than ever heretofore; not only in the amount of it and distribution, but in the most improved methods of handling it. The direct-connected dynamos will be so arranged by the Arnold system, that if either one of the three dynamos or engines break down, the others can be operated. An 800-foot transfer table puts all the shops in communication with each other, and is what Mr. Lyon aptly calls a horizontal elevator, because of its speed—400 feet per minute.

Two Interesting Buildings.

Pictures of two interesting Baltimore & Ohio Railroad buildings have been reproduced in a recent issue of *Truth*. One is the building at Frederick, Md., which has been used since 1831 as a freight station, and which is still devoted to that purpose. In the little cupola of the building a bell once hung, which was always rung on arrival of trains from Baltimore, when horses were the motive power of the railroad.

The other building is the station at Mount Clare, Baltimore, and it is noted as being the location of the first telegraph office in the world. It was from this building that Professor Morse sent his celebrated message in 1844 to his friends in Washington, forty miles away.

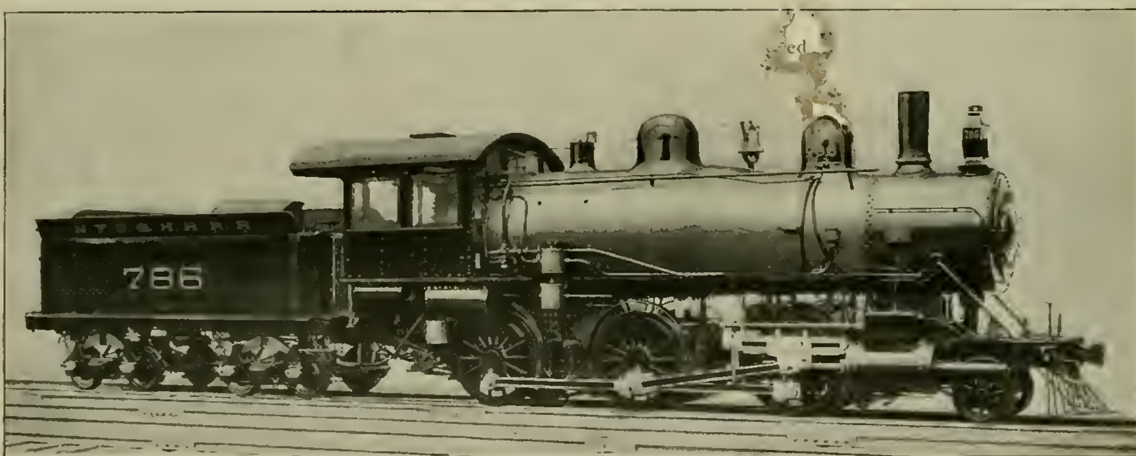
New York Central Mogul.

The handsome mogul locomotive here shown was recently built by the Schenectady Locomotive Works, from specifications prepared under the supervision of Mr. Wm. Buchanan, superintendent of motive power of the New York Central & Hudson River Railroad. The engine was designed to haul heavier trains than the moguls in use are capable of doing, and a series of trips made between West Albany and Dewitt, a distance of 140 miles, particulars of which are given in the annexed table, show that the engine is capable of hauling all the cars that can be comfortably held together. This one pulled eighty-five loaded grain cars and one light car from Dewitt to West Albany, and returning took 126 light and one loaded car from West Albany to Dewitt.

The engine has cylinders 20 x 28 inches, has driving wheels 57 inches diameter, and has a boiler with 2,110.84 square feet of heating surface to provide the steam required. The tractive force of the engine, working full stroke, is about 30,000 pounds, and the coefficient of adhesion is 4. In working order the engine weighs 142,200 pounds, of which 123,000 pounds rest on the drivers. The driving wheel base is 15 feet 2 inches, and the total wheel-base is 23 feet 3 inches. The steam ports are 18 x 1¼ inches, the inside port 2¾ inches wide and the bridges 1⅛ inches wide. The valves are American balanced, have 5½ inches travel, ⅞ inch outside lap and 1-32 inch inside. They are set lapping the port about 1-10 inch in full gear. The centers of the main driving wheels are of cast steel, while the forward and back drivers have steeled cast-iron centers. The driving boxes are of gun iron and rest on journals 9 x 12 inches. The engine truck journals are 6 x 10 inches. The pony truck wheels are spoked, 30 inches in diameter, and have Krupp tires. The boiler, as will be seen, is of the extended wagon top kind, 62 inches diameter, and carrying a working pressure of 180 pounds. It is made of carbon steel, and the sheets vary from 7-16 to ⅝ inch in diameter. The firebox is 108 inches long and 40⅜ inches wide, 78½ inches deep in the front and 66½ inches in the back. The water space in front is 4 inches wide and 3½ inches at the side and back.

The crown is sustained by radial stays, 1 inch diameter, which is also the thickness of the other staybolts. The tubes are of charcoal iron, and there are 310 of them, 2 inches diameter and 12 feet long. The tubes give 1,934.24 square feet of heating surface, and firebox 176.6 square feet, making a total, as has already been mentioned, of 2,110.84 square feet. The grate area is 30.3. The tender has a capacity of 4,500 U. S. gallons, and carries 10 tons of coal. The total wheel-base of engine and tender is 50 feet 4⅞ inches. United States metallic packing is used in piston rods and valve stems. There are two No. 10 Monitor injectors and two 3-inch consolidated muffled safety valves. The American brake is used on all the drivers, and an automatic air brake on tender; a 9½-inch pump being provided to supply the air. A Gould coupler is applied to the front of engine and rear of tender.

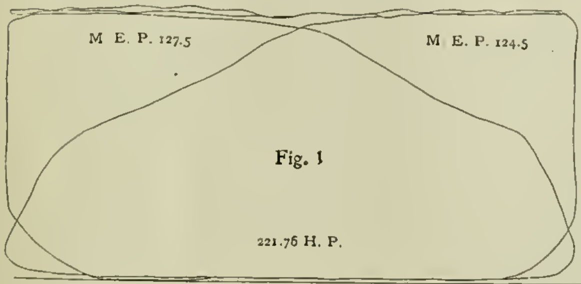
The annexed indicator diagrams are selected from a lot that were taken when the engine was pulling a train of eighty-one cars from Dewitt to West Albany. The train was 3,125 feet long and weighed 3,428 tons. While hauling this train, the engine used 18,575 gallons of water, which weighed 154,793 pounds. The evaporation of the water was done by 21,215 pounds of coal, which was at the rate of 1.86 pound per car mile. The performance of the engine in this run was that of hauling 22.4 pounds one mile for every pound of coal burned. There were 6.97 pounds of water evaporated per pound of coal, which is remarkably high,



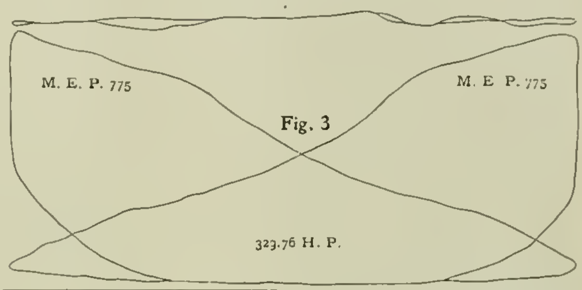
NEW YORK CENTRAL MOGUL.

as it is equivalent to 8.2 from and at 212 degrees.

The tests of the engine were made under the supervision of a representative of the New York Central Railroad, who kept careful record of the coal and water consumed. A car loaded with coal was weighed and coupled to the tender, from which the tender was loaded before start-



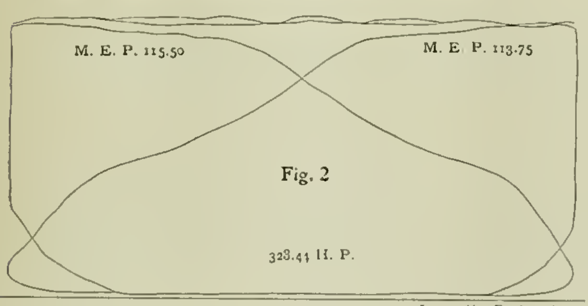
Locomotive Engineering



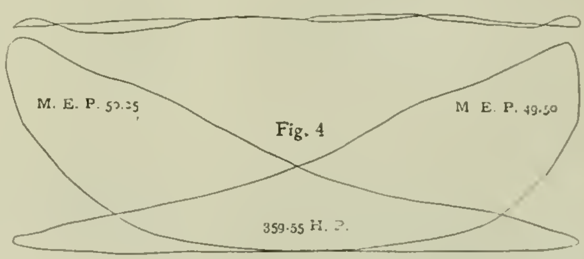
Locomotive Engineering

PERFORMANCE OF NEW YORK CENTRAL MOGUL.

DATE.	September 28th.	September 29th.	September 30th.	October 1st.	October 3d.	October 4th.
Terminal points	W. A. to D. W	D. W to W. A.	W. A. to D. W.	D. W to W. A.	W. A to D. W.	D. W. to W. A.
Weather	Fair.	Fair.	Fair.	Fair.	Fair.	Fair and showery.
Condition of rail	Good.	Good.	Good.	Good.	Good.	Good and slippery.
Velocity of wind	Heavy head 50 mi	Trace.	Trace.	Trace.	Trace.	Trace.
Temperature of atmosphere	....	....	58	67	70	72
Temperature of feed water	63	64 6	65.7	66.1	67.5	68
Steam pressure	177	177.5	178.5	178.5	179	179.5
Elapsed time	10 hr. 12 min.	10 hr. 57 min.	10 hr. 24 min.	12 hr. 5 min.	11 hr. 31 min.	12 hr. 3 min.
Detentions, number of	5	6	5	8	6	6
Running time	9 hr. 10 min.	9 hr 6 min.	8 hr. 55 min.	10 hr. 3 min	9 hr. 49 min.	9 hr. 53 min.
Average speed, miles per hour	15.17	15 27	15.62	13.83	14.2	14 04
Number of cars in train	91 lt., 1 load	1 lt., 71 load.	112 lt., 1 load.	1 lt, 81 load.	126 lt, 1 load.	1 lt., 85 load.
Loaded weight of train, tons	1,441	2,838	1,659	3,063	1,834	3,250
Number of tons hauled 1 mile	200,299	394,482	247,821	425,757	254,926	451,750
Gallons of water used, actual	13,781.6	14,188 2	15,017 8	16,433	16,839 8	17,804 8
Pounds of water used, actual	114 846.6	118,235	125,156.3	136 941	140,331.7	148,373 3
Pounds of water used in run	110,646	114,035	120,956 3	132,541	136,131 7	144,173.3
Pounds of coal used, actual	17,080	16,880	18,280	18 300	20,200	21,120
Pounds of coal used in run	16,480	15,280	17,680	17,700	19,600	20,520
Pounds of coal per car per mile	1.29	1.52	1.13	1 65	1.11	1 71
Coal consumed per 100 tons hauled 1 mile	8.2	3 87	7.7	4 1	7.7	4.5
Tons hauled 1 mile per pound of coal	12.1	25.8	12 8	24	12.8	22
Tons hauled 1 mile per pound of water	1.81	3.46	1 88	3 21	1 88	3.13
Average evaporation per pound of coal, actual	6.72	7.00	6.84	7.48	6 95	7 00
Factor of evaporation	$\frac{H-h}{965.7}$ equa	ls 1.17 average ta	ken for all.			
Equivalent evaporation from and at 212° F. per pound of coal	7.86	8.19	8.00	8.75	8.13	8 19
Per cent. of moisture	1.5 in coal	as weighed.				
Equivalent evaporation per pound of dry coal, average	8.28					



Locomotive Engineering



Locomotive Engineering

ing, and all the coal left in the tender at the end of the trip was thrown back into the car, which was then reweighed. The difference between the two weights represented the amount of coal used on the trip. The tank was fitted with a graduated water-glass and thermometer, which were read before and after each filling of the tank. From these readings the amount and temperature of the water used on the trip were determined. The engine was run under ordinary conditions and handled by the regular crew.

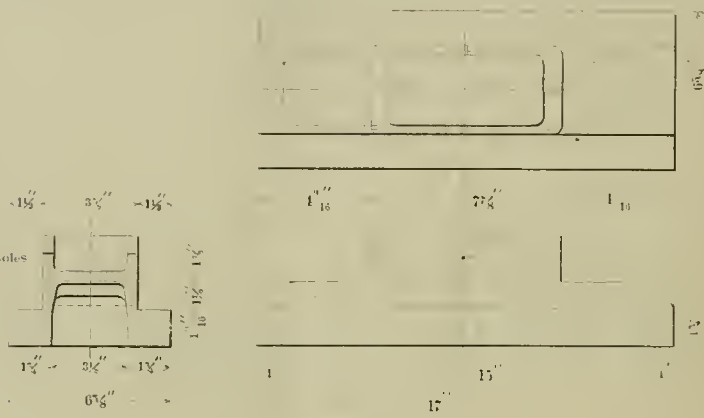
The diagrams show a remarkably good distribution of steam, and there is unusually small drop of pressure from the steam chest to the initial cylinder pressure. No. 1 was taken immediately after the train was got moving, and represents steam cut off at about 45 per cent. of the stroke. The calculation shows that the engine is developing a tractive force of about 24,759 pounds. This was exerting about 7 pounds of pulling effort for every ton of train, including engine and tender. Card No. 2, which was taken on an ascending grade of 4.4 feet per mile, when the engine was running at 11 miles per hour, or about 64 revolutions per minute, represents 22,523 pounds tractive force. This gives 6.3 pounds to move each ton of train. Card No. 3 was taken when the engine was running 16.5 miles per hour, or 97 revolutions per minute, on an ascending grade of 4.6 feet per mile. The tractive force indicated is 15,229 pounds, or 4.5 pounds to the ton of train. Card No. 4 was taken on a descending grade of 3.7 feet per mile, at a speed of 28 miles an hour, which was 164 revolutions per minute. The diagram shows 9,799.5 pounds of tractive power employed, which is only 3.78 pounds per ton of train and engine. The tractive force required to move that train was so extraordinarily low that it does not agree with any of the figures relating to train resistance laid down in the engineering text books. The weight of train was something unparalleled, and there is some reason for believing that the resistance per ton diminishes as the weight of train increases. We do not have sufficient data to speak positively of the power per ton required to keep this train running at 16 miles per hour, but eighteen indicator diagrams which we have examined lead us to believe that the power required for the speed named is under 5 pounds per ton.

A train of eighty-five cars loaded with wheat represents the year's industry of a good many hands. If the land where it was raised produced 20 bushels to the acre, it would take a farm one mile wide and six miles long to raise the load that this train carried.

Valve and Seat of the Winans Camel Engines.

The engraving of valve, seat and yoke, herewith, is from the last of the original Winans camel engines, now being scrapped on the Baltimore & Ohio, at Mount Clare shops. As a link in the evolution of slide-valve proportions, it will be well worth preservation, although it does not represent the valve actually used on the engines as designed by Winans, but is one of the results of the many reconstructions those lasting old-timers have passed through. Mr. H. F. Colvin, of Philadelphia, than whom there is no closer student of locomotive development, informs us that the original valve seats had ports of the same width as shown, but the length was only 12 inches, and there were no strengthening bars in them as in this case.

These port dimensions will strike many of those who are posted only in present-day practice as rather too constricted to give satisfactory results with a 19 x 22-inch cylinder, and the valve travel will also come in for criticism. The latter must have been not more than 3⅜ inches.



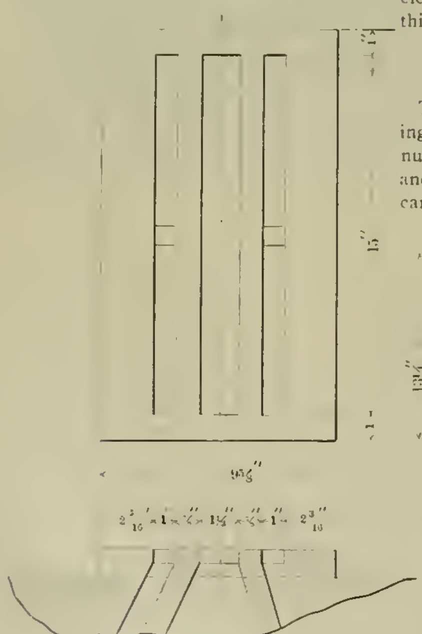
ROSS WINANS VALVE.

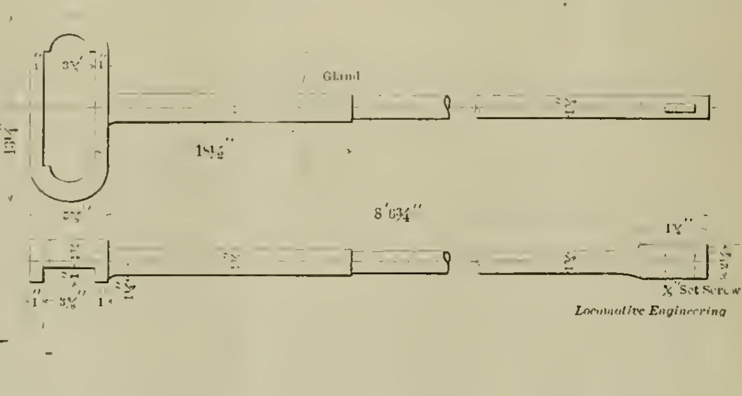
as at that the exhaust port would be choked to ⅝ inch wide when the steam port was full open. These dimensions certainly have an odd appearance in comparison with those of more recent engines having practically the same cylinder volume. Winans was a designer of originality and depth, and in the light of present trend of opinion about the uses of clearance and valve travel, his work in this respect will receive attention.

The Two-Plate Bolster.

The question of body bolsters is receiving renewed attention, as is shown by the numerous illustrations of new designs; and this is a good sign, for it shows that car men, who are more interested in the matter than anyone else, have not given up the idea that a bolster can be made to suit any combination of conditions, no matter how severe or exacting. This is plainly the proper spirit in which to approach the problem to get results. To design a bolster that shall have the requisite strength to sustain a given load is simply a mechanical problem, involving some mathematics, some shop training, and also some good judgment, or what is often written "horse-sense." These are the elements that have produced the correct design of a bolster or any other detail of a car for that matter, and those in touch with this proposition are the ones who have solved the situation correctly for their particular conditions.

One of the most peculiar things in connection with this subject, is the faithful, and we may almost say fatal, adherence to false gods, as shown by the shallow two-plate affair made to go under the sills. Blindly persistent pushing kept this design alive, and did more than any one thing to prevent original thought in establishing a principle that would be of general use. It is plain that the reaction is on at this time, and it is hoped the above construction will be as scarce in the future as it has been plentiful heretofore. it has outlived its usefulness, for the reason that the light loads it could be made to sustain are no longer to be reckoned with, and we are glad to note the improvement in bolsters for the heavier recent equipment, for they all give evidence of more or less familiarity with the elements mentioned above as essential to good work.





ROSS WINANS VALVE SEAT, YOKE AND VALVE ROD.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

A Well Handled Air Brake Train.

The following true story of an engineer's unconscious achievement illustrates the degree of nicety with which a freight train partially equipped with air brakes can be handled by a careful engineer.

There had been a wreck on the Cincinnati division of the Chesapeake & Ohio Railroad, the engine and several freight cars having gone down the bank, piling up. After two days' hard work, the wrecking gang had the engine and three freight cars on the track again, a little the worse for their plunge down the soft earth embankment. The splintered remnants of the other freight cars were burned up where they lay wrecked.

Now begins the interesting part of the story. The mud-painted engine, the three freight cars and the wreck train, consisting of a derrick car, tool car and flat car carrying extra wheels, stood on the spur track awaiting the next west-bound through train to be taken to the Covington shops.

In due time the train, consisting of seventeen air cars, all cut in, and twenty non-air cars, arrived, took in the engine two cars back of the air cars, and the rescued freight cars and the wreck train just ahead of the caboose. Broken sills and bumper beam made necessary two chain couplings, one at the front end of the engine, and one between the wrecked cars in the rear of the train. Thus was made up a most difficult train to handle smoothly, and was accordingly remarked upon by the superintendent and Traveling Engineer Belton, both of whom had been at the wreck, and were now en route home to Covington in the tool car.

"How many break-in-twos are we going to have on the way in, Belton?" asked the superintendent, jokingly.

"None," returned Belton, spiritedly; "I'll bet on it. And the engineer doesn't know that you and I are aboard, either."

The superintendent looked for a moment amused at Belton. "You seem to have a good deal of confidence in your engineer," he said.

"I have," replied Belton, "and I'll go you still one better. See that jack?" he continued, pointing to a narrow-bottomed screw-jack standing on the floor in the middle of the car. "Well, I'll bet you that there'll not be enough shock made in setting the brakes or in starting up to tip over that jack once between here and Covington."

The superintendent smiled at this effusive burst of confidence, then gazed quietly at the floor. He was thinking. He knew the train would have to take siding once, stop once for water, and pull through Covington yards, where two or three stops might be necessary. Under these conditions, a narrow-bottomed screw-jack that could resist the well-known inducements offered at these places to keel over, must necessarily be spiked to the floor, he thought. "I'll take you, Belton!" he exclaimed. So they made the wager. Belton bet a box of cigars, and the superintendent a hat.

Several of the wrecking crew had been listening to the conversation, and soon all eyes in the car were centered on the mud-splashed, greasy jack, standing alone in the middle of the car floor. The train started, and the jack remained erect. The siding was entered, but the jack did not fall. It still stood as the train left the siding. The engineer was doing exceptionally good work. The wreckers and the train crew knew it as well as the superintendent and Belton.

"Here's where I smoke your cigars, Belton," laughed the superintendent, as the train approached the water tank. "I'll bet that jack will be lying in the forward end of the car, among those ropes and blocks there, before the fireman gets the water crane over the man-hole in the tender." Belton did not reply, but gazed steadily at the jack.

The occupants of the tool car were just a trifle excited now, and formed in a ring around the jack, anxiously waiting for the shock of the slack running in. It came; but came very gently, and the jack maintained its erect position.

"That's good work, Belton," exclaimed the superintendent, enthusiastically.

Belton's only reply was a chuckle. He knew that stopping a partially equipped air train of forty cars, in which were a dead engine and two chain couplings, required fine work, and he also knew that his engineer was capable of doing it.

Finally, Covington yard was approached. The train men and the wrecking crew, with dinner pails in hand, stood with the superintendent and Belton in the ring around the jack. Here, now, was the last chance, and it was the best one yet offered to upset the jack. Despotic yard crews, with excited and extravagant signals, were likely at any moment to flag down the train and provoke an emergency application from the usually careful engineer, in which case the jack and everything else that was not tied fast or nailed down would upset. A switch engine did once pull out from behind some freight cars onto the main track, but this had been anticipated by the engineer of the freight train, and an ordinary service stop sufficed to bring the train to a standstill. The little ring of observers back in the tool car thought the jack once slightly leaned forward during the stop. However, it kept its normal position. The final stop found the jack still standing erect in the middle of the tool-car floor. The engineer had done gilt-edged work, and the superintendent had lost his bet.

The engine was cut off and taken to the roundhouse. The ring of watchers broke up and passed out through the rear-end door. Belton wore a bran new hat to church the following Sunday.

Who was the engineer? He is now a prominent member of both the Air-Brake Men's and the Traveling Engineers' Associations. His name is "Ike" Brown; residence, Covington, Ky.

Air Brake Interest in New South Wales

A subscriber and correspondent writes us from New South Wales, as follows:

"I cannot understand how it is that such expense and trouble are taken by your railway companies to make the engine men adepts with the air, and nothing in the form of practical instruction is to be got here—I mean in the form of instructors and instruction cars. I must give heaps of credit to LOCOMOTIVE ENGINEERING for the many valuable paragraphs and items of air-brake information that have appeared from time to time, and which I follow with the greatest of pleasure, affording my mate and me many pleasant hours' chat. We talk all about the other things as well."

A New Air-Brake Book

"Up-to-Date Air-Brake Catechism," as its name implies, is the most recent, and doubtless most complete, air-brake book yet published. It is written by Robert H. Blackall, air-brake instructor and inspector on the Delaware & Hudson Railway The book is made up of 230 pages of judiciously selected and well-arranged matter, both text and illustrative, for the use of air-brake men in all departments. It contains nearly a thousand questions and answers, besides tables of data and results of tests, and will be a valuable addition to all air-brake men's libraries. The book is handsomely bound in dark-red cloth. Price $1.50.

Repairing Triple Valves and Angle Cocks.

Quick-action brakes have now been in use on freight trains more than ten years, and the triple valves must naturally, in the course of time, come in for repairs Some railway companies have undertaken to do the repairing themselves by reboring and refitting the parts, thus departing from standard sizes, and making future renewals of standard parts impossible. Others have found it economical and advantageous to send the worn triples to the manufacturer for repair, where the old bushings are replaced by new ones, and other new parts substituted which make the valve almost entirely new. All standards are thus maintained.

The latter course is certainly the more economical one. An old valve is virtually exchanged for a new one, there is the assurance that the work is properly done, and all parts are kept standard.

The Westinghouse Air-Brake Company has sent out a circular discussing the above question, and offers to place the old triple in a condition as good as a new one. Four dollars is charged for renewing a quick-acting triple, $3.50 for a plain triple, and 70 cents for fitting an angle cock with a new key and bushing. The prices, which may seem high at first glance, will, upon reflection, be seen to be much lower than that at which any railroad company can renew and standardize all the parts of a triple valve or angle cock.

Objections to Loud Sounding Air Pump Exhaust.

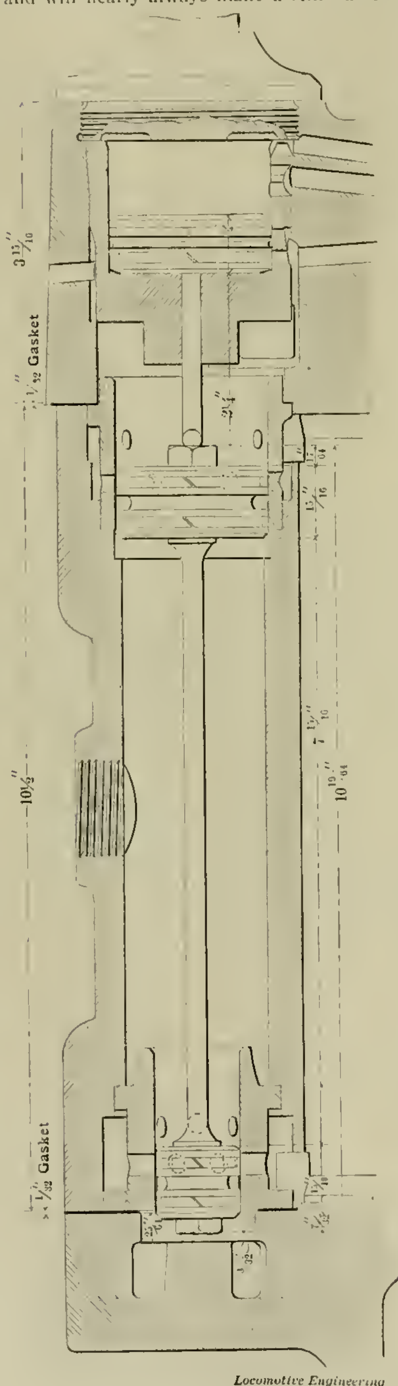
There has been considerable complaint against the loud-sounding exhaust of the air pump on passenger locomotives, and in some sections of the country steps are being taken to abate the nuisance.

Various methods to utilize or dispose of the exhaust, other than that usually practiced, have been employed from time to time on different roads. One scheme is, to tap the exhaust pipe into the exhaust ports of the cylinder saddle, using port cocks to drain off the condensation; another is, not to reduce the opening in the exhaust end of the pipe; still another one is, to turn the exhaust out over the cab roof. We would like to hear from those of our subscribers or correspondents who have had any practical experience with schemes for doing away with the loud sound of the exhaust.

The noise of a hard-working pump is certainly objectionable in thickly settled portions of the country. A person not acquainted with the noise might reasonably wonder whether the pump were a special noise-making device, or merely some saucy piece of mechanism striving to create the impression that it was the whole circus itself, and the remainder of the locomotive was merely a side show.

Hard-working Rotary Valves.

A good many hard-working rotary valves are often due to the material in the gasket between the rotary key and the valve cap. Sometimes ordinary leather is used for this gasket by careless repairmen and engineers, and will produce the same effect as a hard-working rotary valve. The specially prepared leather gaskets furnished by the manufacturer are far better, and will nearly always make a stiff valve handle easily. Several roads make their gaskets from vulcanized fibre, and report good results. We would be glad to hear from correspondents who are having marked success with any particular material for this gasket.



MAIN VALVE FOR EIGHT INCH PUMP.

Main Valve and Reversing Valve of the 8-inch Pump.

In response to several correspondents, and for the benefit of numerous other air-pump repairmen, we illustrate herewith a cut of the main valve, reversing piston and stop pin in the center piece of the 8-inch pump.

About June 1, 1893, the stem was shortened perhaps a full 1-16 inch, by taking a portion off each end and thinning the nuts to suit. This increased the little clearance that was then discovered to 3-32 inch, and it is extremely doubtful if, at the most rapid rate at which the pump can be driven, the stem would ever reach the stop piece when in motion; but, of course, it may drop there when the steam is shut off, if the packing rings are sufficiently loose to permit it so to do.

The rod was reduced and the piston heads lightened by the reduction in weight of material, for the purpose of reducing the effect of inertia, and it is believed the present standard stem is amply able to resist any of the stresses imposed upon it. As a matter of fact, the only compressing strain brought to bear on it, and which is the only one that would cause the stem to bend, is that imposed by the reversing piston pushing down on the upper end for the purpose of admitting steam to the lower end of the steam cylinder.

About the date already mentioned, the removable stop pin was abandoned, and the stop was cast integral with the center piece of the pump. The new stop is clearly shown in the cut.

The Westinghouse Air-Brake Company's instruction car has recently finished a four months' tour of the Intercolonial Railway. As many of the employés on that line taking instructions speak French only, and do not understand English, it became necessary to have in the car an assistant instructor who could give instructions and converse with the class in French. Accordingly, a Frenchman was temporarily employed. Knowing the limited space of the car as we do, and knowing also the necessity for room wherein the Frenchman can make gestures, we naturally wonder how much skin was knocked off his knuckles by striking the apparatus during the trip. For a Frenchman to talk, he must have room wherein to make gestures, and he can't talk if his hands are not free to gesticulate, any more than a mule can kick if his tail is held down.

The Erie freight trains are getting up to very high speeds, if we are to take for gospel the information given out by a certain small city newspaper, which says: "The Erie freight trains make fifty miles an hour over the main line between Kent and Meadville."

Modified form of Reducing Valve for High-speed Brake.

We illustrate herewith a recently modified and improved high-speed brake reducing valve. On account of some little difficulty had in service with the piston stem bending and causing the valve to leak, it has been re-designed, and a number of structural improvements incorporated which will be seen by reference to Fig. 1. The functions and operations of the valve remain the same, and the description given in last month's issue will apply to this new valve, as well as the old one given on page 473.

An Air Pump Puzzle.

A correspondent from New South Wales writes us:

"How would you keep the 9½-inch pump going safely and supply twenty cars of air at 60 pounds train-line pressure, over a mixed grade for 35 miles, if the discharge valve of the bottom end of the pump worked off and you lost the valve but found the cap? My mate and I did it without five minutes' delay. How was it done?"

CORRESPONDENCE.

A Plea for a Better Hand Brake upon the Tender.

Editors:

It frequently occurs that engines "walk off" when left standing unattended and not coupled to train, often causing damage, sometimes of a serious nature. The cause is generally a leaky throttle, brake not applied upon tender or wheels not blocked.

It is probably true, that most engines are equipped with a hand brake upon tender, but it is quite as often true that they are almost useless, from the fact that the ratchet wheel and dog are located upon the deck, where they are invariably covered up by a foot or more of coal. The fine coal mixed with the water thrown upon it finally settles and cements around the ratchet wheel and dog, making it necessary to use a pick to clear it away in order to use the hand brake.

Now, this is almost a reasonable excuse for not using the brake; yet when a "walk-off" does occur, the hostler, engineer or fireman generally catches the blame for not taking precaution against it. While in itself a simple matter, I consider the hand brake upon the tender quite important, and that it should be arranged so as to be available for instant use; and it ought always to be set when engine is standing unattended and not coupled to train.

I fail to see the reason why builders and designers persist in turning out locomotives with the ratchet wheel in the above mentioned location, when any place upon the brake staff, out of reach of the coal, would do for the ratchet wheel, and a suitable bracket for dog could be placed upon the inner side of cistern. Or both

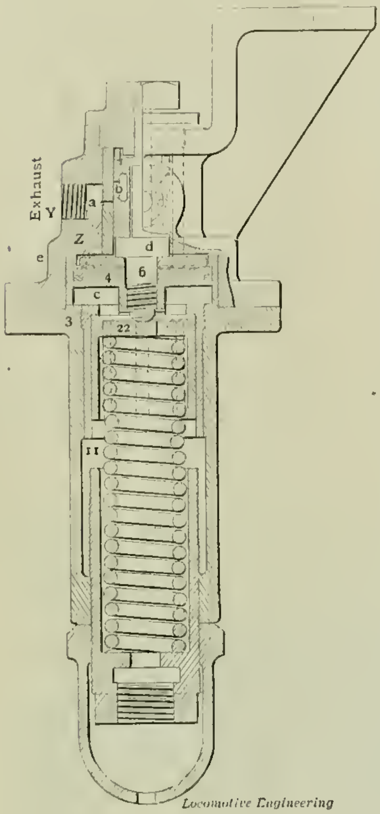
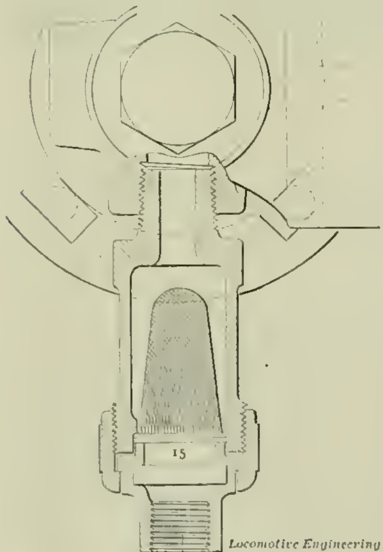


Fig. 1.



Z ↳To Brake Cylinder

TOP VIEW OF REDUCING VALVE.

could be placed below the hand wheel, on top of the cistern, where one hand could be used for holding the dog to the ratchet, while the other turned the hand wheel.

A little detail like this, costing but a few cents to change, would often save dollars.

H. THORNBURG,
Engineer N. C. & St. L. Ry.
Paducah, Ky.

Distance Required for Train Stopping.

Editors:

Among the questions comprising the Third Year's Firemen's Examination is one that reads: "With the same piston travel, will loaded and empty cars hold alike?"

This inquiry could have been worded more clearly, were it not that the intention is to evoke discussion and thought on the part of firemen seeking information to answer these questions for promotion.

I take it that your answer to air-brake question 114 of October would fit the above question, but was not what was wanted by J. K. H. As I understand it, his question, fully stated, would be: "With a thirty-five car train, composed of ten cars air braked and twenty-five non-air, could a stop be made in a less distance from a given speed with the ten cars of air loaded, than with the air cars empty, but the same load carried in the cars behind the air?" Thus the problem would represent two trains of the same total tonnage and the same total braking power, and there should be no difference in the distance required for stopping, assuming, as you say, that the wheels should not slide on the empties, and furthermore that the piston travel is the same on the loads as on the empties.

This latter condition will vary with the method of brake beam suspension. If the beams drop very far below the wheel centers when the cars are loaded, the loss of braking power due to the increase of piston travel will cause the empty cars to make the shorter shop.

I would take no practical point on the effect of curves on the pulling or stopping of trains with loads ahead or behind, although there is some difference.

E. W. PRATT,
Gen. Air-Brake Insp., C. & N. W. Ry.
Chicago, Ill.

Concerning the High-speed Brake.

Editors:

I am a reader of LOCOMOTIVE ENGINEERING, and was much taken up with the detailed description of the high-speed brake.

On page 474, in referring to a 10-pound reduction in a train pipe of 110 pounds obtaining 60 pounds in the brake cylinder, it seems to me that this would be impossible, unless you had a 2 or 3-inch travel with the cylinder leakage groove stopped up. With an 8-inch travel it would take almost 20 pounds reduction to obtain 60 pounds in the brake cylinder. Taking your statement as a basis, you could make two consecutive service applications of 60 pounds in the brake cylinder, and then have enough left to apply as hard

PLANT SYSTEM AIR BRAKE CAR AND INSTRUCTOR F. C. CROSS. TIME, AUGUST.

as with the common quick-action brake with 70 pounds to start with. Please explain

L. M. CARLTON,
C. & N. W. Ry.

Eagle Grove, Iowa.

[The statement was not what it should have been. We wished to bring out the fact that three service applications and one emergency could be had before pressure fell too low to give a full emergency. Perhaps the better way to set the matter straight would be to cite some experiments that were made at the Westinghouse Air-Brake Co. shops, as follows: With an auxiliary reservoir charged to 110 pounds pressure a reduction of 19 pounds pressure in the train pipe was necessary to obtain 60 pounds pressure in the brake cylinder; this left 91 pounds in the train line. During the few moments in which the piston was returning to the "full release" position the reservoir and train line was recharged to 95 pounds. A reduction of 15 pounds in train pipe pressure was thereafter necessary to obtain 60 pounds pressure in the brake cylinder: this left 80 pounds pressure in the train pipe, which with the auxiliary reservoir, as in the preceding case, during the release, was augmented some 4 pounds. A third application was then made by reducing train line pressure 15 pounds to obtain 60 pounds pressure in the brake cylinder. This left 69 pounds pressure in the train pipe and auxiliary reservoir, which, as in the preceding cases, was increased to 73 pounds during the restoration of the cylinder piston to its normal position of release, and there was still enough pressure left in the auxiliary reservoir to have made a full emergency application.—Ed.]

Location for Main Reservoirs.

Editors:

Herewith enclosed please find photograph of mogul engine, showing location of air drums on top of the boiler. You will note that there are two short drums placed side by side, and the bell on top of the drums. This makes a very neat arrangement, puts them up out of the way, and gives good satisfaction.

C. T. McELVANEY.
Master Mechanic, M., K. & T. Ry.

Denison, Texas.

(See page 521.)

QUESTIONS AND ANSWERS
On Air Brake Subjects.

(115) H. F., North Paterson, N. J., asks:

How much pressure was carried on the old, straight air brake? A.—It varied greatly; sometimes 70 or 80 pounds, and ofttimes 100 or more.

(116) W. C. G., Chester, Pa., asks:

Why is it, when cutting out a defective brake, the rules are, to leave the bleeder open on a passenger car, but close it on a freight car? A.—The rule should be, to leave the bleeder open on both passenger and freight cars cut out for defects. Most roads have this rule.

(117) H. F., North Paterson, N. J., writes:

With a fifty-car train, would you make a better stop with the first twenty-five cars cut in solid, than if every other car of the fifty was cut in, making twenty-five cars in either case? A.—In the first case, with an emergency application, the stop would perhaps be a trifle shorter, but the shock in the caboose would be greater In the second case, the stop would probably be a little longer, but smoother.

(118) H. F., North Paterson, N. J., asks:

Why is it dangerous in double heading to allow both engines to assist in the recharging of the train, as mentioned in question 62, June number? A.—There is not so much objection to both men charging the train pipe at the same time, but there is danger of the second man charging and knocking off brakes while the first man may be trying to set them. See answer to question 62, June number

(119) T. E. F., Bergen, N. J., asks:

1. Why was the old-style signal valve and reservoir abandoned? A.—1. The new style is much simpler in construction and accurate in operation. 2. How can more blasts be obtained with the new style than with old style? A.—2. With the new style, less time is required to recharge the chambers in the whistle valve than was required to charge the reservoir and whistle valve in the old style. Hence, more blasts can be had in a given time.

(120) H. F., North Paterson, N. J., asks:

Why is it not allowable to cut out every other car on a long train when you have a poor air pump? A.—Cars are usually cut out because of leaks, and in cutting out every other car, the tight part is cut out, and the leaks remain, because nearly all leaks are in the train pipe, hose couplings, etc. Thus good brakes are lost, and the leaks remain. It is much better to keep all cars cut in, even though a lower pressure be carried.

(121) T. E. F., Bergen, N. J., asks:

Why would a shoe having a 9-inch bearing on the tire wear out faster than one having an 18-inch bearing, if one has just as much of a holding power as the other, as stated in question 49, May number? A.—If the same pressure be applied to each shoe, the 9-inch shoe, having only half the area in square inches as the 18-inch shoe, will have double the pressure to the square inch that the 18-inch shoe has. Hence, there being more pressure per square inch on the 9-inch shoe, it will consequently wear away faster.

(122) W. B. M., Columbia, Pa., writes:

If I have 50 pounds in my train pipe and auxiliary reservoirs, and no pressure in my brake cylinders, what pressure will I get on my brake-cylinder pistons if I make a full application or 20-pound reduction in my train pipe; service application, and brake cylinders to be 8, 10 and 12-inch? A.—Not considering the loss of pressure absorbed by the pipe between the auxiliary reservoir and brake cylinder, and the clearance in the brake cylinder, the pressure would be, approximately,

SNAP SHOT OF THE INTERIOR OF THE PLANT SYSTEM INSTRUCTION CAR.

38 or 40 pounds in each of the 8, 10 and 12-inch cylinders.

(123) W. C. G., Chester, Pa., asks:

If the small port in the side of reversing piston bush is to serve as cushioning for the piston on the downward stroke, why is it that the port don't come into the chamber under the piston, instead of against the piston rod? A.—The port referred to does not cushion, but serves to drain off condensation from the top of the piston and carry it to the piston rod, where it does duty as a water packing. The cushioning of the piston is done by the exhaust steam coming in from the main exhaust passage through the several small ports in the opposite side of the bush.

(124) J. G. D., Montclair, N. Y., asks: Is not the occasional breaking in two when a hose bursts due to the brake going on first on the rear end, and the engine jerking the train in two before the front brakes have had time to apply? A.—It would have that tendency, but there is little doubt that very few trains so blamed break in two because of hose bursting. Hose parting is different. However, the jerk of the locomotive and tender is not so great as is frequently supposed. In tests with fifty-car trains, when a break in two occurs, it nearly always happens at very low speed, just a few moments before the train comes to a standstill, and long after the engine has "jerked."

(125) J. G. D., Montclair, N. Y., writes: On page 65, Air-Brake Men's Proceedings, 1897, speaking of the improved device for cutting out in double heading, it is stated that train-line pressure is registered through pipe *N* and the cut-out cock. As the cut-out cock is in the main reservoir pipe, and pipe *N* connects below the equalizing piston, would like to know how train line is thus registered. A.—In the device mentioned, train-pipe air passes from the bottom of the brake valve, through pipe *N* and top part of cut-out cock plug, up around on top of the rotary valve, holding it down. Train-line pressure is registered on the red hand, as usual, from chamber *D*. Main reservoir pressure is registered through pipe *G*, on black hand, as usual.

(126) G. C. C., Lowell, Mass., writes: I have seen notice posted in enginehouse forbidding emergency application of the brake on turntable. I claim that no emergency is had unless you get some air from train pipe into brake cylinder, which cannot be done, as the engines are equipped with plain triples. Am I right? A.—Emergency application is merely setting any kind of brake as quickly as possible. It can be made with any kind of air brake, and even with the hand brake. Quick-action application can only be had with the quick-action triple, and consists of taking part of train pipe pressure into the brake cylinder in emergency application. The rule forbidding emergency applications on turntables is a good one, as it protects the rotary valve from dirt drawn up out of the train pipe.

(127) W. C. G., Chester, Pa., writes: Question 349 of the Progressive Questions and Answers on Air says one car was found where there was a terrific blow through the exhaust port all the time the brake remained applied. The answer which follows says the only way that such a case could occur would be through the emergency valve remaining opened, permitting the air to pass from the train pipe to the cylinder, then through exhaust. Please state how the air gets from the cylinder through the exhaust port when the triple is in application position. A.—In this case the triple was likely in the release position. The train pipe air came through emergency valve to brake cylinder, and set the brake. Air entered the cylinder faster than it could get out. The brake was, for the time being, really a straight air brake instead of automatic.

(128) W. B. M., Columbia, Pa., writes: C. B. Conger says in his Catechism, that with 90 pounds main reservoir pressure and 70 pounds train line, after a full service stop is made by drawing down to 50 pounds, the air will equalize at about 65 pounds. Now, on this division we carry 70 pounds train line and 100 pounds main reservoir pressure. Please say what it will equalize at. A.—The size of the main reservoir and number of cars to be charged controls that. If you have the same size main reservoir and same number of cars that Mr. Conger has used, you will get a little higher equalization. That is as near as we can say just now, but if you will send us the outside measurement of your main reservoir, length and size of piping, and number of reservoirs and size on the engine, tender and cars, we will be glad to give you the figures asked for.

(129) H F., North Paterson, N. J., writes: If a man saw danger ahead and made an emergency application, and almost immediately the danger passed away, should he let train come to a stop before trying to release, or should he try to release before stopping? The point I want is, would he break in two after a full emergency if he released without stopping?—long and short passenger and freight trains to be taken into consideration. A.—Brakes should be released on both long and short passenger trains before coming to a full stop, as there is little, if any, danger of breaking in two, because of the close couplings. Although it is done, releasing brakes on longer freight at slow speeds is likely to break the train in two. At higher speeds, there is not so much danger, providing steam is not used until after the rear brakes are off.

(130) J. G. D., Montclair, N. Y., writes: What is the lap position spoken of in the last numbers of Locomotive Engineering as existing between release and running, if the port were not elongated? What would happen if the port were not elongated? A.—In the D-8, or 1890, brake valve, port *e* in the rotary seat is elongated towards the feed port *f*. If it were not for this elongation, there would be a position, just before the rotary opens up the running position ports, where there would be another lap position, and no air could pass from the main reservoir to train pipe. With the elongation, there is no intermediate positions between full release and running where the main reservoir can be cut off from the train pipe. The celluloid piece on the diagram sent out with the instruction book shows the feed port *f* partly open before the cavity *c* closes. This is wrong on the chart, as it is not intended that way.

M. K. & T. MOGUL, SHOWING LOCATION OF MAIN RESERVOIRS (SEE PAGE 520).

The Great Northern has some mammoth box cars built for transfer service between St. Paul and Minneapolis. These cars are 57 feet long inside, and have two side doors at each side to facilitate loading and unloading. There are eight truss rods with an immense drop to hold up the load over the great span indicated by the above inside length.

Winter is coming on. Get into the habit of draining the main reservoir

How to Lay Out a Locomotive Boiler—Method of Laying Out a Taper Course or the Frustum of a Right Cone and Its Application to the Laying Out of an Elbow.

BY HENRY J. RAPS.

Occasionally it becomes necessary in shortening or lengthening an old boiler to make a taper course. The taper is usually so slight that a very large radius is necessary to lay out the circular edges of the plate.

It is therefore impossible to mark off these arcs by the use of the trams, and some other method must be resorted to.

Let it be required to make a taper course as shown in Fig. 1. We will take the length from the line *A B* to *C D*, which is 40 inches, and add enough to connect to the other courses. The diameter of large end is 50 inches; that of small end is 49 inches. The circumference of large end is 3.1416 × 50 inches = 157.08 inches. The circumference of small end is 3.1416 × 49 inches = 153.9384 inches.

Draw the line *A D*, Fig. 2, 157.08 inches long, bisect it and draw the line *E F* at right angles with *A D*. Forty inches from *A D*, and parallel with it, draw the line *B C*, 153.9384 inches long, placing one-half on either side of the line *E F*.

If we now divide the length of the line *A D* by the difference between the length of the lines *A D* and *B C* and multiply the result by the length of the line *E F*—we will have the perpendicular hight of the triangle, whose slant hight is equal to the radius of the arc *K V L*, Fig. 2.

157.08 — 153.9384 = 3.1416, and 157.08 ÷ 3.1416 = 50; 50 × 40 inches (the length of the line *E F*, Fig. 2) = 2,000 inches, or the length of the perpendicular.

To find the versed sine of the arc of which the line *A D*, Fig. 2, is the chord, or the distance from the line *A D* to *V*, square one-half the length of the line *A D*, Fig. 2, and divide by twice the length of the perpendicular. 157.08 ÷ 2 = 78.54; 78.54 squared = 6,168.53. 2,000 × 2 = 4,000, and 6,168.53 inches ÷ 4,000 = 1.54 inches, or the versed sine, which, added to the length of the perpendicular, 2,000 inches = 2,001.54 inches, or the radius.

Mark off 1.54 inches from *E* to *V* on the line *E F*, Fig. 2.

The versed sine of the line *B C*, Fig. 2, is found in the same manner, viz.:

153.94 ÷ 2 = 76.97; the square of 76.97 = 5,924.38. For the length of the perpendicular we have 2,000 — 40 = 1,960; 1,960 × 2 = 3,920. 5,924.38 inches ÷ 3,920 = 1.51 inches, or the length of the versed sine of the line *B C*. Mark off 1.51 inches from *F* to *V* on the line *E F*, Fig. 2.

For greater accuracy we will find the location of the arcs half-way between the center and extremities of the lines *A D* and *B C*, Fig. 2. By squaring the radius and subtracting from the result the square of one-fourth the line *A D*, we will have the square of the perpendicular of right angled triangle of which *E H*, Fig. 2, is the base and the radius of the arc *K L* the hypotenuse.

One-fourth the line *A D*, 157.08, = 39.27; square of 39.27 = 1,542.1329. Radius = 2,001.54; square of 2,001.54 = 4,006,-162.3716 — 1,542.1329 = 4,004,620.2387. If we now find the square root of this number we will have the length of the perpendicular, and the difference between the perpendicular and 2,000 inches, or the hight of the larger triangle, equals the distance from the line *A D*, at *G* and *H*, to *X X*, Fig. 2.

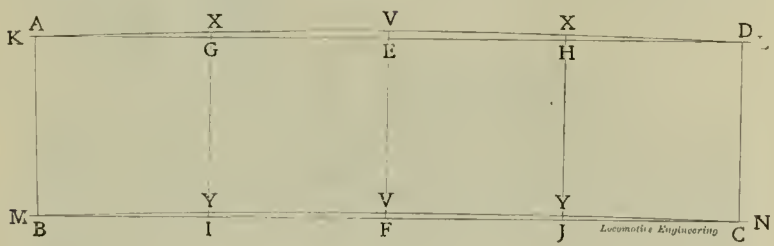


Fig. 2.

The square root of 4,004,620.2387 = 2,001.15 inches, — 2,000 inches = 1.15 inches. Quarter the lines *A D* and *B C*, Fig. 2, and draw the lines *G I* and *H J*; mark off 1.15 inches from *G* to *X* on the line *G I*, also from *H* to *X* on the line *H J*, a flexible strip of wood may be laid along the points *A X V X* and *D*, and a line drawn forming the arc *K L*.

The points *Y Y*, Fig. 2, are found in the same manner as *X X*.

Base = 153.94 inches ÷ 4, = 38.485 inches; the square of 38.485 = 1,481,-.0952 +. Radius = 1,960 inches + 1.51 inches = 1,961.51 inches; square of 1,961.51 = 3,847,521.4801 — 1,481.0952 = 3,846,-040.3849; square root of 3,846,040.3849 = 1,961.13, and 1,961.13 inches — 1,960 inches = 1.13 inches. Mark off 1.13 inches from *I* to *Y* on the line *G I*, and from *J* to *Y* on the line *H J*, Fig. 2, and draw the arc *M V N* through the points *B Y V Y* and *C*. The calculation is the same for any other point of the arc.

As the plate Fig. 2 is to form that part of Fig. 1 enclosed by the lines *A B*, *B C*, *C D* and *D A*, we must add 2¾ inches to the circular sides of pattern for connecting to other courses, the holes to be laid out on a line 1½ inches outside of the arcs *K V L* and *M V N*, Fig. 2. If the straight seam is double, enough must be added for the extra row of rivets. If single, simply add lap.

Let us lay down a rule for calculating the length of the perpendicular and the versed sine for laying out a plate to form

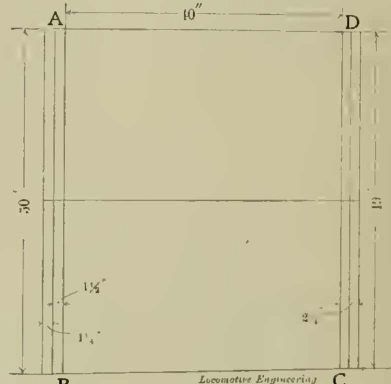


Fig. 1.

a tapered course or the frustum of a right cone.

Rule.—Divide the circumference of the large end by the difference between the long and short circumference and multiply the result by the length of the frustum; the result will be the length of the perpendicular.

For the difference between the long and short circumference in the foregoing example we have 157.08 — 153.9384 = 3.1416, and for the perpendicular we have, by simple proportion:

3.1416 : 157.08 :: 40 : 2,000.

To find the versed sine of the large end, divide the square of one-half the long

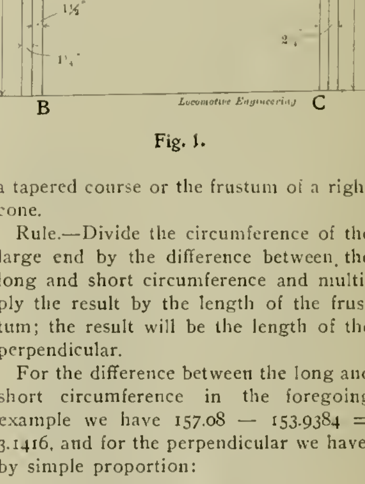


Fig. 3.

circumference by twice the length of the perpendicular.

For the versed sine of the small end, divide the square of one-half the short circumference by twice the length of the perpendicular, minus the length of the frustum.

For convenience let us put the rules in the form of formulas, using the letters marked on Fig. 3.

Let A = one-fourth the long circumference.
b = one-half the short circumference.
B = one-half the long circumference.
C = the long circumference.
c = the short circumference.
L = length of frustum.
P = perpendicular of large triangle.
p = perpendicular of small triangle.
R = radius of arc of large end.
V = versed sine of line C.
v = versed sine of line c.
x = distance from the line C to the arc on the quarter.

Then $P = \left(\frac{C}{C - c}\right) L = \sqrt{R^2 - B^2}$

$$p = P - L$$

$$R = \sqrt{B^2 + P^2} = P + V$$

$$V = \frac{B^2}{2P} = R - P$$

$$v = \frac{b^2}{2p}$$

$$x = \sqrt{R^2 - A^2} - P$$

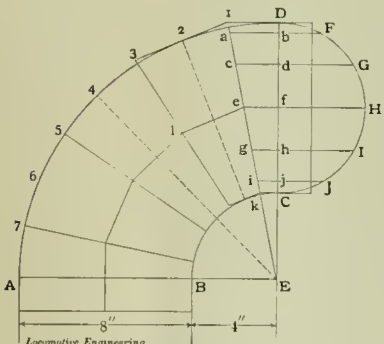


Fig. 4.

To illustrate the application of the rules to the laying out of an elbow, we will lay out the pattern for the center courses of an 8-inch elbow with 4-inch throat, as shown in Fig. 4; we will suppose the elbow is to be made of No. 14 iron.

Draw the lines *A E* and *E D*, Fig. 4, at right angles to each other; with *E* as center, radius *E A*, or 12 inches, draw the quadrant *A D*; with *E* as center and radius *E B*, or 4 inches, draw the quadrant *B C*. Divide the quadrant *A D* into eight equal parts, as 1, 2, 3, etc.; draw the line *E* 1; with *f* as center, radius *f D*, draw the semi-circle *D H C;* divide the semi-circle into six equal parts, as *F*, *G*, *H*, etc., and draw lines—at right angles with *E D*—from these points to intersect the line *E* 1.

To lay out the plate, we will find the circumference of pipe, making it 8 inches inside on the big end and 8 inches outside on the small end. As No. 14 iron is about .07 inch thick, we have for the diameter of small end at the center of iron 8 inches — .07 inch = 7.93 inches, and 3.1416 × 7.93 inches = 24.90, or 24 29-32 inches.

For the large end we have 8 inches + .07 inch = 8.07 inches, and 3.1416 × 8.07 inches = 25.34 inches. In order to make the joints come together without too much labor, we will add ¼ inch to the large circumference; 25.34 inches + .25 inch = 25.59 inches, or 25 19-32 inches.

As each section of the elbow, Fig. 4, is a tapered course or frustum of a cone, the rule laid down will apply. For the length of the frustum we will take the mean length from *e* to 1, Fig. 4, which is 3¼ inches, or 3.25—equal to twice the distance from *e* to *f*. Applying the rule, we have 25.59 inches (long circumference) — 24.90 inches (short circumference) = .69 inch; 25.59 ÷ .69 = 37.08, and 3.25 (the length of frustum) × 37.08 = 120.50 = the length of perpendicular, or by simple proportion:

.69 : 25.59 :: 3.25 : 120.50.

For the versed sine we have 25.59 ÷ 2 = 12.795; the square of 12.795 = 163.71; 120.50 (the perpendicular) × 2 = 241, and 163.71 inches ÷ 241 = .679 inch, or 11-16 inch, = the versed sine.

Draw the line *A D*, Fig. 5, 25 19-32 inches long, bisect it at *E* and draw the line *E F*, at right angles with *A D;* 3¼ inches from *A D*, and parallel with it, draw the line *B C*, 24 29-32 inches long, placing one-half on either side of the line *E F*. Connect the points *A B* and *D C*. Equidistant between the lines *A D* and *B C* draw the line *G H*. From *I* to *V*, on the line *E F*, mark off the length of the versed sine, 11-16 inch; with a flexible strip of wood draw the arc *G V H*.

Divide the lines *A D* and *B C* into twelve equal parts and connect the points. Make the distances from *e* to *f*, *g* to *h*, *i* to *j*, etc., Fig. 5, equal, like distances on Fig. 4, measuring the distances from the arc *G V H*, Fig. 5. The rivet holes are placed at the points so found and lap added. As the difference in the length of the versed sines, of large and small ends, is very slight, allowance may be made for it when the marks are centered.

As the length of the end courses, and also their shape, is different from the center courses, separate patterns must be made for them.

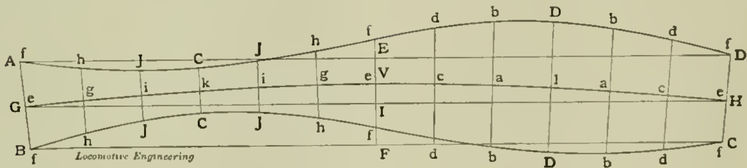


Fig. 5.

The Brainerd Shops.

There is every sign of improvement visible round about the Northern Pacific shops at Brainerd, Minnesota. A system of electricity for lighting and driving is about to be installed, and accounts for the activity at the present time. The 18 x 42-inch Reynolds-Corliss machine-shop engine that has been in constant service since 1882, will be taken to drive the dynamos, and the power-house is now under way. This engine, always too large for its work, can now be an earning factor. The company have appropriated $40,000, we understand, for these improvements, and are among the first of railroad shops, if not the pioneers, in an exclusive electric drive for shop tools. This move gives an idea of the spirit of progress animating the officers of the new Northern Pacific. Superintendent of Motive Power Forsyth is making his influence felt in all these new moves that are placing the road in the front rank of railway management. These shops are in charge of Master Mechanic Bean, and will soon be in the first class.

Baldwin-Westinghouse Electric Mine Locomotive.

In a recent letter to the Westinghouse Electric and Manufacturing Company, Mr. R. G. Vance, Jr., superintendent of the Stevens Coal Company, makes the following statements regarding the Baldwin-Westinghouse electric mine locomotive in operation in their mines:

"It gives us pleasure to say that this motor is giving the very highest possible satisfaction and is attracting considerable attention in this valley. It has been running since May 1st, and has not cost a dollar in the shape of repairs, excepting a new valve for sand box and a headlight base broken in a collision with a car. It is running on a road of 25-pound steel, 4,000 feet long, over undulating grades varying from 1 to 6 feet per 100 feet. Its regular load now consists of twenty cars of 1½ tons capacity, and the time required for each round trip is from 17 to 19 minutes. We have pulled as high as twenty-five of these cars at one trip, which it did with all ease. When necessity requires, we can pull thirty cars, giving 50 per cent. more capacity than you guaranteed."

The United States Metallic Packing Company, Philadelphia, Pa., report a very good business in all classes of engineering, stationary and marine, as well as in locomotive work. Their multi-angular packing is meeting with great favor, and the first set put into service is still doing good work.

Draft Appliances—Ash Pans.

(First Paper.)

BY F. P. ROESCH, UNION PACIFIC, DENVER & GULF.

The following deductions are based on a series of experiments extending over a period of ten years, with different engines and coals. They are not theories, but demonstrated facts, easily verified.

No problem in railroad economics is worthy of more serious consideration than that of fuel economy in locomotives.

A very small percentage of the calorific value of the fuel introduced into the locomotive firebox is actually utilized; the loss being from 15 to 60 per cent. under favorable circumstances, and from 60 to 90 per cent. under most unfavorable conditions. This loss, then, makes fuel combustion in the locomotive firebox a most fertile field for experiment and research.

The only practical solution of the problem is to so arrange the draft appliances as to entirely consume the gases arising from the combustion of the coal and to utilize as many as possible of the heat units contained therein.

We must admit that, with the present design of locomotive, nearly always under a heavy forced draft, with boiler and firebox often too small for the work required, it is utterly impossible to obtain anywhere near the amount of work that should be obtained from the coal consumed. Nevertheless, there are few engines now running on which a marked saving could not be effected, if the subject received the consideration to which it is justly entitled.

There is but one right way to regulate the draft of a locomotive, and that is, to begin with the ash pan and end with the stack.

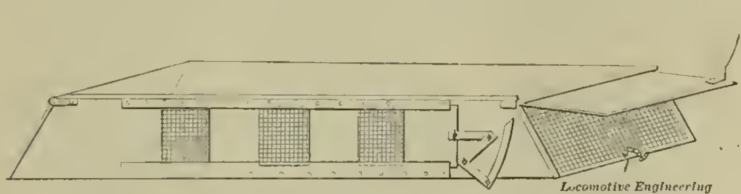
As the oxygen contained in the air is absolutely necessary to produce combustion, and as this air should be admitted through the ash pan, the ash pan therefore becomes one of the essential factors in the draft arrangement.

Many different schemes have been tried for the admission of air above the fire, but with little success. This is caused by the fact that air so admitted enters through a free opening, with nothing to retard its progress. Consequently, it rushes through the firebox at such a high velocity that it does not become heated to the right degree to thoroughly mix with the hydrocarbons distilled from the coal in the process of combustion.

I do not mean to assert that air admission above the fire always results in a dead loss; but I will say that, as a rule, the loss is greater than the gain.

This being the case, our only remedy is to admit the necessary amount of air into the ash pan and through the fire. The velocity of the air being thus retarded by its passage through the fuel, it has time to become heated to the right degree to combine with the constituents of the coal.

Sinclair, in his "Combustion and Smoke Prevention on Locomotives," says, "An engine burning 3.53 pounds of coal per mile on each square foot of grate surface, requires at least 20 pounds of air passed through the grates, to furnish oxygen enough for each pound of coal burned. At this rate, our engine must draw in $20 \times 3.53 = 70.60$ pounds, or 917 cubic feet of air per mile, for every square foot of grate area. With a grate area of 17 square feet, this engine must draw in $17 \times 917 = 15{,}589$ cubic feet of air every mile run." Assuming the engine to be running at the rate of 30 miles per hour, or a mile every two minutes, air must be drawn in at the rate of $15{,}589 \div 2 = 7{,}794.5$ cubic feet per minute, and this through two openings (the dampers) having an area of less than 5.08 square feet each.



ASH-PAN PROPOSED BY F. P. ROESCH.

Imagine, if you can, the effect of a blast like that striking the fire from beneath, coupled with the draft of a strong exhaust pulling at the fire from above. Is it any wonder that the fire is torn full of holes, unless it is kept very deep?

We can here learn something from the makers of lamp burners. Notice that on all lamp burners the air passes through a screen on its way to the flame. This is to prevent the admission of sudden gusts of wind, which would give a flickering, unsteady light, and would at times extinguish the flame altogether. Working on the same lines, we find that gusts of air are to be avoided equally the same in a firebox as in a lamp burner. The remedy then is, to admit the air in sufficient quantities, but in such a manner as to overcome that cyclonic effect in the ash pan. The best way to accomplish this is to put auxiliary dampers, composed of netting or perforated iron, over the damper openings, under the solid damper; these auxiliary dampers to be kept tightly closed not only to break the inrush of air into the ash pan, but also as a safeguard against dropping fire.

But we find we have now so contracted the damper openings that the remaining area is insufficient to admit the amount of air required. We must therefore cut panels out of the sides of the ash pan and insert netting or perforated iron. This gives us a sufficient air opening, and at the same time so distributes it as to strike the fire with equal force at all points. This ash pan can be rigged up with side dampers to be closed when standing at stations or drifting down hill.

The Carnegie Consolidation.

The magnificent engine here shown is the heaviest locomotive built up to this time, and is notable not only for the size and weight, but for the fine designing, which did not put in one pound of weight that was not necessary for the strength of the parts to which it belonged.

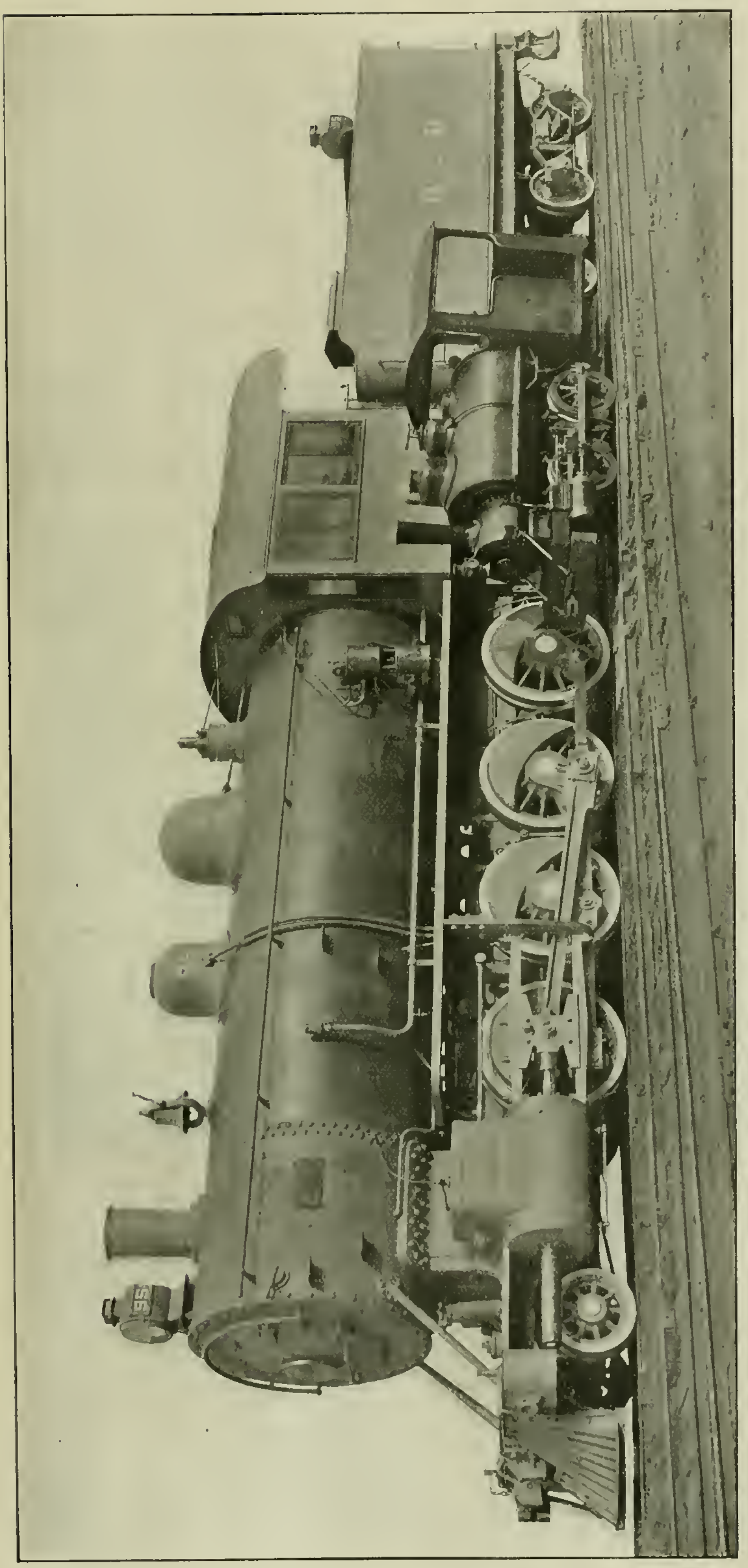
The Union Railroad, for which the 23 x 32-inch consolidation locomotives have been constructed, is a part of the Carnegie system, connecting the Duquesne Furnaces, Homestead Steel Works and Edgar Thomson Steel Works, and extends, nominally, from Munhall to North Bessemer, Pa., a distance of about twelve miles. Some four miles of the line has a grade of 70 feet to the mile, while about 2,000 feet (a point commencing at the yards near Edgar Thomson Steel Works, and passing up over the line of Pennsylvania Railroad and ending at the foot of the 70-foot incline) there is a grade of 2 4-10 per cent.

The locomotives are being operated daily upon this line, and steam freely, and, so far, appear not to be extravagant in the use of fuel and water. We hope soon to give some figures showing fuel and water consumption and tonnage hauled on the grades.

The cylinders are of the half-saddle type, made heavy, and have great depth, longitudinally. A steel plate, 1⅜ inches thick, and of the same width as bottom of saddle, extends across and is bolted to lower frames, and to this plate, as well as to frames, the cylinders are securely fastened. Heavy bolts passing through top frame bars, front and back of saddle, form additional transverse ties, and relieve the saddle casting from all tensile strains. Longitudinal strains usually transmitted to cylinders through frames are largely absorbed by the use of a casting extended from bumper beam well up to the saddle, securely bolted to top and bottom front frames. This casting also acts as a guide for the bolster pin of truck. This method of relieving cylinders of longitudinal stress was introduced by the Pittsburgh Locomotive Works nearly two years ago, and has proven, in practical use on a large number of locomotives, to be of great value in reducing breakage of saddle castings.

The frames are 4½ inches wide, and have been cut from rolled steel slabs made by the Carnegie Steel Co., and weigh 17,160 pounds per pair, finished.

The total weight of the engine is 230,000



LARGEST LOCOMOTIVE YET. BUILT BY PITTSBURG LOCOMOTIVE WORKS FOR THE UNION RAILROAD.

pounds, 208,000 of which rest on the drivers and 22,000 pounds on the truck wheels. The tender, loaded, weighs 104,000 pounds. The tractive power of the engine is 53,293 pounds. For such a powerful engine, the wheel-base is by no means long, being only 24 feet. The wheel-base of the drivers is 15 feet 7 inches; the total length of engine and tender being 55 feet 3½ inches. The center of the boiler is 9 feet 5⅜ inches above the rails, and the top of the stack 15 feet 6 inches. As might be expected from the look of the engine, enormous heating surface is provided, the total being not less than 3,322 square feet; 3,116.5 of that is in the tubes and 205.5 in the firebox. The grate area is 33.5 square feet. The main driving wheels are cast steel centers; the centers of the other wheels are cast iron. The journals of the driving wheels are 9 x 12 inches, and of the truck 6 x 10 inches. The main crank pin is 7 x 7 inches. As already mentioned, the size of the cylinder is 23 x 32 inches, and the piston rod is 4½ inches diameter. The main rod is 9 feet 10½ inches from center to center. The steam ports are 20 x 5½ inches and the exhaust ports 3¼ inches wide; the bridge is 1½ inches wide.

The valves have 1-inch outside lap and a set of 1-16 inch lead in full gear. The travel is 6 inches. The boiler was tested with water of 300 pounds, and it is designed to carry a working pressure of 200 pounds. Thickness of the barrel steel is ⅞ inch, and the diameter at the front sheet is 80 and 83½ inches at the throat sheet and 74⅝ inches at the back head. The crown sheet is supported by stays 1⅛ inches diameter. There are 355 tubes of knobbled charcoal iron, 2¼ inches diameter and 15 feet long. The firebox is 10 feet long, 40¼ inches wide, 76¾ inches deep at the front and 69 7-16 inches at the back. The crown sheet is 7-16 inch thick, sides and back ⅜ inch, and tube sheet ½ inch.

The engine has Westinghouse American brake, pneumatic sanders, and two 3-inch open pop safety valves and one 3-inch muffler. Water is supplied through two No. 11 injectors.

The Shelby Steel Tube Company are now making their seamless steel tubing in small sizes and in fancy shapes for ornamental work. These include square, rectangular, half-round, hexagon, fluted, twisted flutes, etc., etc. It is being used in place of brass for racks and similar fixtures in passenger cars, being both cheaper and lighter than the brass. There should be a good demand for these shapes.

Now is the time for club-raisers to get to work and roll up their list for 1899. It promises to be a good year for large clubs.

The Cause of Trains Parting.

Through the courtesy of Mr. J. W. Thomas, Jr., assistant general manager of the Nashville, Chattanooga & St. Louis Railway, we have received reports giving particulars of trains parted during the greater portion of the year. We publish two of the reports, for the purpose of showing railroad men the kind of information obtained and the method of tabulating it. The parting of trains is a fertile cause of accident and delays, and anything that will serve to reduce the breaking in two will save a great deal of time and money to railroad companies.

Since the Nashville, Chattanooga & St. Louis began this practice of having full reports of all partings of trains tabulated, it has been the means of reducing the partings about 50 per cent., and Mr. Thomas believes that a continued supervision will still further reduce this kind of expensive accident. We believe that every practical railroad man will agree with him in this respect.

Making systematic reports of the causes that lead to trains breaking in two, furnishes information that can be used to provide remedies. The Nashville, Chattanooga & St. Louis seem already to have received valuable statistical information on this point that will enable them to provide means of prevention. In nine sheets of data concerning breaking in two, which we have not published, we find that 190 breakages had taken place. Of these thirty-three were caused by M. C. B. couplers parting, twenty-seven by broken coupling pins, twenty-four by slip pin

NASHVILLE, CHATTANOOGA & ST. LOUIS RAILWAY.

Office Assistant General Manager.

TRAIN PARTED REPORT W. & A. DIVISION—AUGUST, 1898.

No.	Date.	Train No.	Engine No.	Conductor.	Engineman.	Cars. Ld.	Cars. Mt.	Ser. Air Cars.	Cause.	Remarks.
1	3	15	9	Arrington	Boston	24	1	5	Slip pin broken	Brakes were set up on rear of train; engineman released his brakes, jerking train in two.
2	3	9	12	Hildebrand	Keenan	20	....	8	Slip pin key lost.	
3	5	17	12	Hildebrand	Keenan	18	....	9	Pin broken	Pin gave way as train was being started; pin not sent in for examination.
4	5	8	23	Varnon	Jones	20	....	11	M. C. B. couplers parted	Conductor could not tell which knuckle opened.
5	5	8	39	Holcombe	Manning	14	12	10	Knuckle pin broken	Train was running along; old flaw.
6	6	15	39	Holcombe	Manning	19	2	14	Link broken	Steady pull.
7	8	11	5	Holcombe	Miller	22	....	6	Slip pin key gone.	Train was stopping at switch.
8	11	17	21	Dunn	Jackson	17	....	10	Slip pin key gone	Slip pin key lost out of S. I. C. L. 15,254.
9	11	13	28	Offutt	Woolbright	24	3	5	Coupling pin jumped out.	
10	17	14	12	Vandivere	Keenan	10	17	19	M. C. B. couplers parted	Knuckle of Gould coupler in F. G. E. 12,288 opened, allowing train to part.
11	19	Ex.	12	Morgan	Keenan	20	....	5	Slip pin broken through keyway	Train was being stopped to take siding.
12	20	14	30	Martin	Hetzel	12	11	16	Knuckle pin jumped out	Piece of wire twisted around knuckle pin; no further trouble experienced.
13	20	Ex.	12	Morgan	Keenan	20	....	5	Slip pin gave way in keyway	Old flaw.
14	22	9	11	Vandivere	Kiser	18	4	10	M. C. B. couplers parted	Train parted twice between cars equipped with Mo., Pac. & Chicago couplers; put chain around drawbars; no further trouble; conductor could see no reason for couplers comin apart
15	23	9	21	Landrum	Fisher	....	20	20	Knuckle broken	Train of empty tourist cars; knuckle gave way in Pullman car 2,652 as train was starting into siding.
16	26	10	22	Vandivere	Mimms	11	18	5	Coupling pin jumped out.	
17	30	13	21	Martin	Hetzel	20	....	6	Knuckle pin worked out.	

J. W. THOMAS, JR., *Asst. Gen. Manager.*

NASHVILLE, CHATTANOOGA & ST. LOUIS RAILWAY.

Office Assistant General Manager.

TRAIN PARTED REPORT CHATTANOOGA DIVISION—AUGUST, 1898.

No.	Date.	Train No.	Engine No.	Conductor.	Engineman.	Cars. Ld.	Cars. Mt.	Ser. Air Cars.	Cause.	Remarks.
1	2	7	114	Harris, T. O.	Gilman	16	1	3	Slip pin gave way	Head of slip pin in S I. C. L. 53,718 pulled off; poor iron; old flaw
2	4	10	97	Owens	Hailey	27	....	11	Draft-timber bolts gave way	Draft timber bolts in B & R. 275 gave way; evidence of rough handling.
3	5	12	130	Drake	Hight	14	5	7	Slip pin key lost	Train parted as it was being started from station; evidence of rough handling.
4	8	9	85	Eskridge	Lucas	18	....	9	Link broken	Iron good; evidence of rough handling.
5	11	16	87	Tucker, R. M.	Gurnee	4	28	11	Pin pulled	Conductor claims someone pulled pin while train was standing at station.
6	12	9	92	Brakefield, G. W.	Burns	22	...	6	Slip pin pulled thr'gh end of dr'wbar	Head of slip pin in S I C. L. 1,087 badly worn.
7	13	15	148	Hensley	Hight	27	...	12	Draft timbers broken	Evidence of rough handling.
8	14	8	85	Poe	Lucas	13	6	3	Slip pin key gone	Slip pin key worked out going down mountain.
9	14	15	148	Hensley	Hight	26	....	15	Knuckle broken	Knuckle in St. L. R. C. Co 674 broken in starting; evidence of rough handling
10	15	17	85	Hibbett	Lucas	16	....	12	Slip pin key lost	Slip pin key lost out of C. H & D 11,452; train was running along with light throttle.
11	15	16	25	Moore	Gibson	11	11	13	Slip pin key jerked in two	Three sections coupled together coming down mountain; all had trains partially equipped with air; first man thought he was going to run by switch and called for brakes; second man applied brakes lightly; instead of bringing train to stop as per instructions, first man whistled off brakes, and as brakes released train parted.
12	17	14	93	Drake	Gower	11	12	10	M. C. B. couplers parted	Conductor could not tell which knuckle opened.
13	18	10	119	Hensley	Petty, C.	1	19	13	Draft timbers pulled out	Dr ft timbers in N . & St. L. 1,608 rotten; car being brough to shops for repairs.
14	20	4	100	Harris, J. H.	Petty, J	9	....	9	Link broken	Solid link between engine and postal car broken; link showed old flaw
15	24	13	108	Montgomery	Gibbons	....	18	18	Miller drawbar pulled in two.	Train consisted of 18 tourist cars; Miller drawbar had old break and pulled in two as engineman released brakes to pull in siding.
16	24	12	25	Brakefield, G. W.	Gibson	8	16	13	Slip pin gone	M. C. B coupler in S I C. L. 1,966 fell on track, derailing two cars: track blocked 2½ hours.
17	31	13	94	Lathan	Austin	18	.	6	Slip pin broken in keyway	Slip pin key in N. C. & St. L. 8,139 gave way through keyway; old flaw.

J. W. THOMAS, JR., *Asst. Gen. Manager.*

keys getting lost, sixteen by broken links, sixteen by slipped pins getting broken, twelve from coupling pins jumping out, and eight by slip pin keys getting broken. Fourteen trains broke in two through coupling pins getting lost, and eleven had the same experience through knuckle pins getting broken. Five drew apart, owing to broken knuckles. Eight came to grief from such causes as defective draft timbers, drawing out of draw-heads, and similar minor defects.

Canadian Pacific Ten-Wheeler.

The ten-wheel engine here shown was recently built at the Canadian Pacific Railroad shops at Montreal for fast heavy passenger service. The engine is compound, after the Pittsburg system, and has a total weight of 126,000 pounds, of which 96,000 rest on the drivers.

CANADIAN PACIFIC TEN-WHEELER.

The cylinders are 19 and 29 inches diameter, with 24-inch stroke. The driving wheels are 62 inches diameter, and have cast-iron centers. The driving axle journals are 8 x 8½ inches, and the truck journals 5 x 8 inches. The main pin is 6 x 6 inches. The steam ports of the high-pressure cylinder are 20 inches long, and of the low-pressure cylinder 21 inches. The width of the ports is 1¾ inches for the high-pressure side, and 2 inches for the low pressure. The widths of the exhaust ports are 3 inches for high pressure and 3½ inches for low pressure. The bridges on the high-pressure cylinder are 1⅛ inches, and on the low pressure 1¼ inches diameter. The valves are Morse balanced, and on the high-pressure side have a travel of 5½ inches, while on the low-pressure side the travel is 6 inches. The lap of the valves is ⅞ inch, and there is ⅜ inch inside clearance.

The boiler is the Belpaire type, with conical connection with wagon top, and is designed to carry working pressure of 200 pounds per square inch. The material is steel 9-16 inch thick, and the diameter of boiler outside of waist is 53¾ inches. The horizontal seams are double riveted with safety rows and inside and outside welts. The circumferential seams are double riveted. The crown sheet is supported by direct stays.

The firebox is 96½ inches long inside, 42⅝ inches wide, 60¼ inches deep in front and 45¾ inches deep in the back. The tubes are all charcoal iron, and are 216 in number, 2 inches diameter. All the rest of the boiler is steel. The tubes are 11 feet 8 7-16 inches long. The tubes provide 1,320 square feet of heating surface, and the firebox 120 square feet, making a total of 1,440 square feet. The grate area is 28.6 square feet.

Among the special equipment to be noted on the engine are the Westinghouse American brake, with 9½-inch Westinghouse pump. The Westinghouse air signal is also used. There are Nathan sight-feed lubricators and Gresham & Craven injectors. United States metallic packing is used for valve stems and piston rods. There are Krupp tires, Leach sanding apparatus and Crosby steam gages. The heating apparatus is consolidated. Commingler system.

Day Coach Service.

The Erie's No. 7 leaving New York at 7.40 P. M., has some little points in the way of train service that excite flattering thoughts in the minds of those who ride in the so-called day coach, with its porter. The presence of an attendant in a through day coach is not enough of a novelty to descant on at length; but the kind of service obtained is often a good theme on which to work up comparisons. Observation shows that the Erie porters are never lax in their attention to passengers, nor in their other duties, such as keeping the lights at a proper intensity for those who want to read, or turned down to a delightful softness for those courting a few minutes with Morpheus, or again, rounding up the noisy yokel who insists on riding in the through car instead of in the car for local passengers. We saw some of these things, and they form a bill of particulars that led us to think that the porters of these trains are not excelled by any for their unremitting attention to passengers. It is not necessary to ring for them—they are always in sight.

They make good time with the Black Diamond Express pretty regularly, but when they get laid out at connections a few minutes there is hustling to get the time made up. Engineer Farley has several fast runs to his credit with the "669," one of which is especially good. He made the 176 miles from Sayre to Buffalo, with three slow-downs, in 169 minutes, actual running time. Nothing slow about that.

Book Notices.

"Catechism of the Steam Plant," by F. F. Hemenway. Press of LOCOMOTIVE ENGINEERING, New York. Fifty cents.

Unlike many of the catechisms for engineers, this contains no "fillers"—i. e., questions asked simply to fill space. They are all practical, everyday questions, such as occur to an engineer, and are likely to be asked by the examiner when you face the inquisition to obtain a license. It is a handy book for the pocket; is bound in a durable cover, and contains 128 pages of just the facts an engineer or fireman wants to know about, by an author who has no superior in this line. In addition, he shows how the different calculations used may be done, and gives a little elementary arithmetic to help along the reader. While intended chiefly for stationary engineers, it contains much of value to anyone interested in steam engineering.

"History of the World." By John Clark Ridpath. Published by Merrill & Baker.

This is a work of eight volumes, four being devoted to the history of nations, and the remainder to the history of mankind. That they are well written, interesting and authentic, goes without saying when we know the author. Briefly, yet as fully as is desirable, it gives the history of the different races and nations, and as a work of reference it is invaluable. The manner of treating the different subjects makes it interesting reading instead of hard work digging out facts of history, as is too often the case. Instead, the reader is carried along to incident after incident in the history of his nation or his race, and is loath to stop even after he has found the particular bit of information he was looking for. The illustrations are profuse, and add much to the work, which should be in every home as a means of informing the household on any subject of history which may be under discussion. Every school boy or girl, to say nothing of the parents, is constantly asking questions which cannot be answered offhand, and by placing such a work at their disposal they will learn more than in any other way.

"Hand-Book of Corliss Steam Engines," by L. W. Shillitto, Jr. American Industrial Publishing Company, Bridgeport, Conn. $1.00.

This is a well printed little book of 191 reading pages, which seems to give in plain language much information that anyone handling Corliss engines should know. It deals with foundations, Corliss valves and valve gears, dash pots and general construction, and also devotes considerable space to valve setting. Indicating is touched on lightly, and several useful tables are given. Nearly all of the different makes of Corliss engines are shown; but we regret that the Bates-Corliss, with its ingenious valve gear, is not among them. The leading types are shown, however, and we believe the book will prove useful to many.

Richmond Locomotives for Finland.

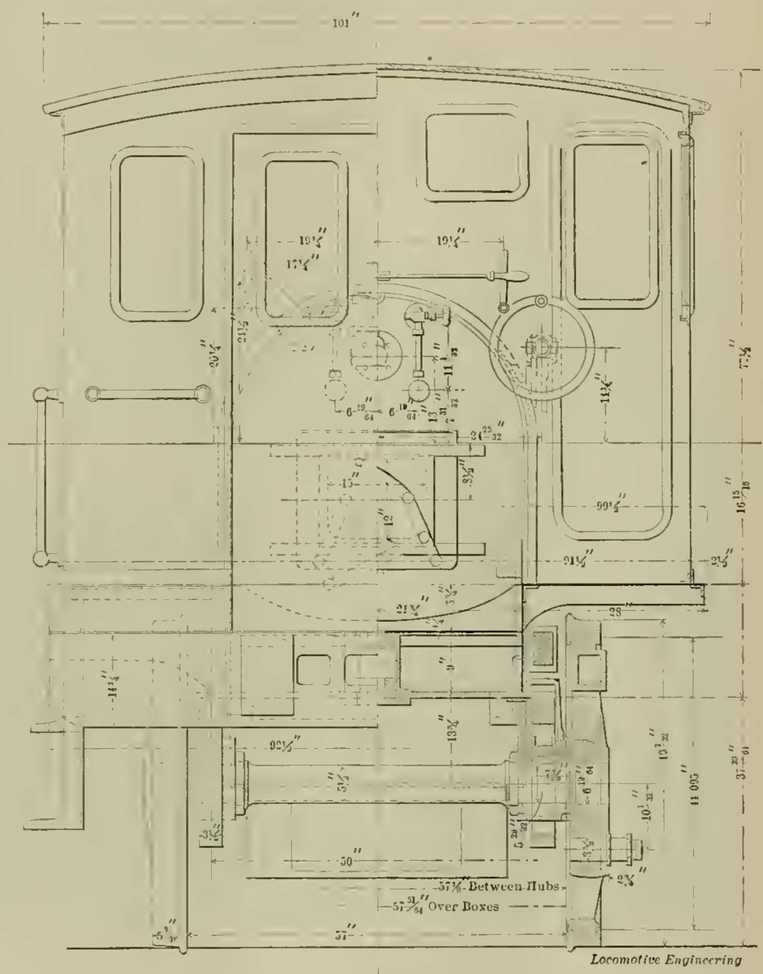
These locomotives are probably the most foreign of any which have been built in the United States, having fewer of the builder's characteristics than any we have seen. In fact, with the exception of the Richmond compound cylinders, it would be easy to believe they were made abroad.

The cylinders are 15¾ and 25 inches in diameter, by 20 1-16 inches stroke—the odd dimensions here and elsewhere being due to metric measurement of specifications.

The boiler is 44 13-16 inches in diameter, and has several peculiar features, some of which may be seen from the elevation, and others may be noted later. The boiler checks, injectors, etc., are of German manufacture, and were sent here to be put in place. The cab is steel, with all the openings or panels finished with a half-round polished brass molding, riveted into place.

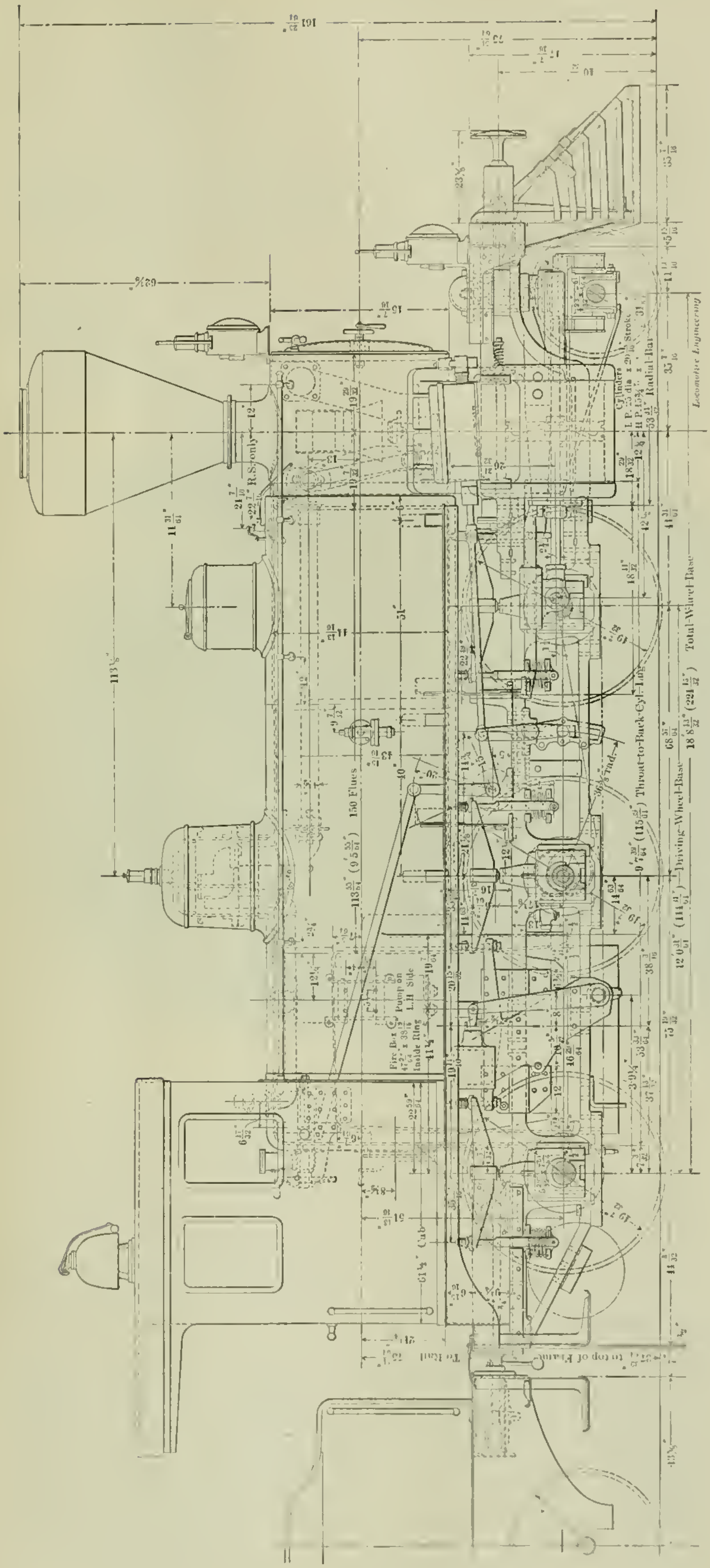
The view in the cab shows the reversing wheel on the right, the throttle lever above it, and the side elevation shows the bell-crank arrangement, as well as the throttle valve itself. The construction of the dome itself is also interesting.

The driving axle is seen to be entirely foreign practice—the large wheel fit of 6 19-64 inches, collar between this and the bearing, which is 5 29-32 inches diameter by 7⅞ inches long, and two further enlargements, before reaching the axle proper, of 5½ inches. One of these collars carries a larger collar against the inside of the driving box. The firebox doors slide as shown, a few being in use in this country. The wheels are forged, of the Vauclain type, with tires held by retaining rings, as shown. The drivers are 49 7-32 inches in diameter. The spring rigging is a little odd, as will be seen from the fulcrum blocks at each bearing point, together with lock nuts above and coil springs beneath. It will also be noticed that the equalizers set on pivots over each driving box, giving a perfectly free movement in every direction.



REAR VIEW OF FINLAND LOCOMOTIVE.

The air brake is the English pattern of



RICHMOND LOCOMOTIVE FOR FINLAND STATE RAILWAY.

the Westinghouse, and the pump is on the left-hand side. Pintsch gas is used in all the headlights, three of which are used in front.

There is a novelty over the cab in the shape of a steam bell, which was first shown in this country at the World's Fair. Steam simply lifts a piston and opens to the air, which relieves the pressure and allows the steam to escape, the hammer falling by its own weight. The tender is made with a plate frame, and the springs placed between the plates, making a very neat arrangement, and attracting attention by its general appearance.

There were seventeen engines in all, most of which are wood burners; but the last few are to be made into coal burners.

A few of the leading dimensions follow: Total weight, 68,000 lbs.; weight on drivers, 53,000 lbs.; weight on trucks, 15,000 lbs; heating surface, fire-box, 69.6 sq. ft.; tubes, 674 sq. ft.; total heating surface, 743.6 sq. ft.; grate surface, 12.2 sq. ft. The tubes are brass with copper on fire-box ends and the fire-box is copper. The small grate and heating surface is in marked contrast to the Carnegie Consolidation, on page 525.

Locomotive Efficiency and Capacity.

(First Paper.)

BY C. A. SELEY.

The expression "the efficiency of the modern locomotive" is often used when the more correct term would be "the capacity of the modern locomotive." There has been practically very little advance in the efficiency of the locomotive as a steam engine in more than forty years. This may be a broad statement, but an examination of a strictly modern "flyer" will disclose no radical difference in the essential parts of the machinery when compared with those of years ago. Cylinders, pistons, rods, cranks, valves operated by a link motion; are seen on every engine, and some of them not so well designed as those used by our grandfathers.

As the law governing the expansion of steam is an immutable one and unchanging, it follows that in order to obtain a higher grade of economy or efficiency in the use of steam, some other mechanism than the ordinary reciprocating engine must be used. Outside of the application of the compound principle, there seems to be no feasible design in the present state of the art that is available for locomotive purposes.

It would therefore seem that the great advance in capacity (not efficiency) of the modern locomotive has been brought about by the perfecting of the details of the machine, in enlarging symmetrically the various parts as greater power and speed were demanded, in minimizing the losses from radiation and friction, by the use of modern discoveries in coverings, bearing metals and packings.

Elaborate experiments in expansion of

steam in a single cylinder have demonstrated that the most economical point of cut-off is at not less than one-quarter stroke. The old-time engines were run at the same cut-offs as we now employ; and as greater power and speed were required, the demands were met by increasing the old-time steam pressure of 120 pounds by successive steps to the now not uncommon 180 pounds, and 14-inch cylinders have grown inch by inch, until last year we saw a simple engine with 21 x 34-inch cylinders. The long stroke of this engine tempts one to believe that the designer was seeking for increased efficiency in following Western river steamboat practice.

However, 26 and 28-inch stroke are now frequently met with, the object being to increase the capacity of power in drawbar pull, as length of stroke is one of the factors of the tractive power. To increase locomotive capacity and retain high efficiency is a matter of great interest, not only to the designer and mechanical engineer, but to all those in any way connected with the motive power and the operating departments of railways. Concentration is the tendency of the age, and large engines decrease operating expenses.

The compound non-condensing principle, as applied to locomotives, is yet a debatable advantage in net money efficiency in the minds of many railroad men. Large claims are made, and theory admits an increased economy; but the compound is not old enough yet, and its record not that clear as to admit it as a superior machine under any and all conditions.

The inherent difficulties which may be partially overcome seem to be these: Unless used with a fairly large wheel, the reciprocating parts of the four-cylinder compounds are difficult to counterbalance for any very high piston speed.

Notable engines have been produced by using large wheels, high pressure and light parts of extremely high-grade material and fine design; but for heavy, powerful, everyday engines, where comparatively small wheels are necessary for traction, the problem becomes a difficult one. The two-cylinder compound is less difficult to handle in this respect, but there arises the necessity for providing a valve motion that will so distribute the steam in all the running cut-offs that the work done in both cylinders will be approximately alike, else one side will be stronger than the other, and unequal wear and cutting flanges will ensue. All this may be simpler and easier to overcome than it sounds, but it is certain that a higher grade of intelligence will be required to make the adjustments and measure the performance of these engines than is now required for ordinary locomotive repair and adjustment.

The valves of a compound cannot be set by sound.

Our railway mechanics are undergoing an evolution. The old-time, all-around mechanic, good anywhere, is disappearing, and in our shops are specialists, men who do one round of work day after day. It is not their fault, but the custom of doing the work more and more on the system of the manufacturing shop, and to secure thereby a cheaper output, is responsible for this. Most large shops have of late years largely cut the cost of work in this way, but it inevitably results in a lowering of the average mechanical ability of the men. For this and other reasons connected with the general difficulty of getting anything new taken up by railway men, it would seem that the compound has to fight its way into favor by sheer good works. The special features of these engines, such as proper lubrication under the high pressures, perfecting of the starting and intercepting valves, draft appliances and boiler work, will occupy many bright minds for some time yet before the compound is not the *bete noir* of not only the motive power, but the operating department also.

There are, however, in this country a vast number of locomotives in service of ample capacity for the work they are doing, and those in charge might obtain a very considerable gain, both in efficiency and capacity, if the details of these engines were thoroughly and understandingly gone over in the light of modern locomotive engineering knowledge. There is a strong conservatism in railroad management that seems to regard an engine once built as done for all time, that im-

AIR BRAKE INSTRUCTION CAR OF THE AMERICAN MAGAZINE LEAGUE.

provements are doubtful and that changes are expensive experiments. When shopped they must be turned out just as originally built.

Conditions have changed, however; knowledge has increased, and while we can design a new engine to meet perfectly the changed conditions of handling traffic, as regards power and speed, would it not be wise to bring our ten and fifteen-year-old engines up to date, when by study and moderate expense this can frequently be done? It is not intended to advocate perpetuating the old light engines that are not in the scrap heap, just because they are not so labeled; but most every road has a lot of fairly good engines that the modern conditions of hauling traffic have put almost to the limit of their endurance. These are really the engines that form the backbone of the American railway systems, and which will over and again repay the time and money spent to bring them up to date.

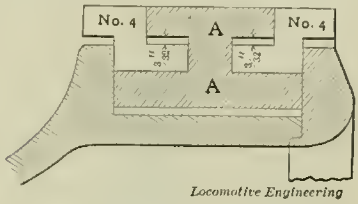
Wisconsin Central Shop Notes.

In our June issue we described at considerable length the new Brooks ten-wheel locomotives on the Wisconsin Central. These engines are interesting on account of the novelties introduced, and also on this account we were interested in knowing how these minor changes withstood the test of road service, and whether they were of permanent advantage. The engines have been doing excellent service for over six months, and fully justify the work of the designer in establishing the various ratios and theoretical capacities. At the same time, experience has shown that some of the "new departures" required modification.

(1) Piston Valves.—The arrangement of packing rings proved unsatisfactory, as steam would work under the rings and set out the packing so hard as to create considerable friction. The original arrangement of valves and packing rings can be seen on page 283 of the June number of LOCOMOTIVE ENGINEERING. Fig. 1 illustrates an improvement effected by Mr. Angus Brown, superintendent of motive power. That modification has, much to their relief and satisfaction, helped matters very much. A bull ring *A A*, Fig. 1, has been substituted for rings in old arrangement. Since the adoption of the bull-ring form, the engines handle very easily and satisfactorily.

(2) Valve Stem.—For some unaccountable reason, the engines came with valve stems with a curved offset. This continually gave trouble, on account of springing, and a straight, round rod has been substituted. There is sufficient clearance all around for the straight rod, and the wonder is why it was ever curved.

(3) Driving Spring—Front Drivers.—This is a poor design; not on account of making one spring do the duty of two, by placing across the engine, but resting the ends on top of the driving boxes without suspension links. Considerable difficulty has been developed, and making the spring saddles larger does not seem to help matters. They all break on the inside. There are two kinds of strains delivered to the saddle—that due to the



BULL RING OF PISTON VALVE.

super-imposed load, and that due to chafing on account of the movement of the spring.

This same difficulty was experienced with the tender truck springs on the New York Central, but since link suspension has been adopted, no further trouble is experienced.

The First Mastodon.

It may surprise some of our readers to know that Ross Winans, one of the most original locomotive builders we have ever had, built an engine of the Mastodon type in the latter fifties.

The eight drivers were 43 inches in diameter, while the four truck wheels were 24 inches. The cylinders were 22 by 22 inches. It had an 11-foot firebox, and weighed 33 tons, according to one account, and 45 tons by another. This was called the "Centipede," and it is recorded in several old works on railroading. It had the engineer's cab at the front end of boiler, the fireman being at the usual place.

The Mason Regulator Company, 6 Oliver street, Boston, have issued a new catalog and price-list of their steam regulating devices and steam pumps. It illustrates their well-known air-brake pump regulator, which nearly every air-brake man knows by reputation, if not by personal use. The catalog is small and handy for reference.

For want of room in their old place, the Star Brass Manufacturing Company have moved to new quarters at 108-114 East Denham street, Boston. They have installed many new tools, and with their increased factory space have ample facilities for doubling the former output, and can insure very prompt shipments.

Jenkins Brothers, New York, have put upon the market a magnetic lamp holder for incandescent electric lamps. It will be found particularly handy in railroad repair shops, in holding the lamp in the best position for throwing light where it is most wanted. Send for the descriptive folder.

Stresses in Main and Side Rods.

Main and side rods of locomotives are subjected to similar stresses, differing only in degree. These may be summed up as tensile, compressive and transverse. The first and second are due to the horizontal effort of the piston, and the third to centrifugal force. Of the horizontal stresses, that of compression takes precedence over that of tension, for the reason that in the former case the rod is a column and must resist lateral flexure, while a much less area will enable it to withstand a like force in tension. For slow running engines these forces only need be considered, but for those of high speed, attention must be given to stiffness in the plane of oscillation, or the rod will bend in that direction.

The horizontal force on the main rod of an engine equals:

$$P = \frac{\pi d^2}{4} p,$$

in which

P = force.
$\pi = 3.1416$.
d = diameter of cylinder.
p = boiler pressure.

If cylinders are 18 x 24 inches and boiler pressure 180 pounds per square inch, we have:

$$P = \frac{3.1416 \times 18^2}{4} 180 = 45,800$$

pounds. The smallest section of a main rod, to resist this force in tension, must be of such an area as will bring the unit stress to a safe figure. If the rod is made 2 x 3 inches at the small end, the unit stress S will $= \frac{45,800}{6} = 7,633$ pounds.

The length of such a rod is usually 8 feet from center to center, or about 6 feet 6 inches in the body—that is, between butt ends. To determine its stability as a column resisting lateral flexure, it may be considered as fixed at both ends. By the formula for the investigation of columns the maximum compressive unit stress equals:

$$S = \frac{P}{A}\left(1 + q \frac{l^2}{r^2}\right)$$

in which

S = unit stress.
P = force.
q = constant for fixed ends.
l = length in inches.
r = least radius of gyration.
A = area of the rod at center.

Substituting values, we have:

$$S = \frac{45,800}{7.5}\left(1 + \frac{78 \times 78}{36,000 \times 0.33}\right) = 6,100 \times 1.512 = 9,200$$

pounds per square inch. The tendency to lateral flexure is shown by the increase from the average unit stress of 6,100 to 9,200 pounds.

Unwin, in "Machine Design," says, in considering the effect of centrifugal force in main rods, that "it is accurate enough to estimate the bending forces due to the oscillation of the rod as if it were a uniform rod of diameter d at its greatest section, or of the breadth b and hight h if the section is rectangular." The rod under discussion is of rectangular form and tapering to a depth of 4½ inches at the back. We may assume that the weight w is 0.28 $b\,h$ pounds, or an average of 3 pounds per inch of length. The force due to inertia per inch of length for any distance x from the front or crosshead end equals:

$$F = \frac{w\,v^2}{g\,R}\,\frac{x}{l} = 60 \text{ pounds},$$

in which

w = weight.
v = velocity in feet per second.
$g = 32.2$.
R = radius of crank.

Speed taken at 50 miles an hour. The bending moment $M = \frac{1}{16} F l^2$, taken at the point at which stress is sought, in this case at a distance 0.66 of the length from front end. Introducing proper values, we have, approximately, according to Unwin:

$M = \frac{1}{16} \times 60 \times 96^2 = 34,560$ inch pounds.

Dividing this bending moment by the modulus of the section, $b\,h^2 \div 6$, which equals 5.66, we have:

$$S = \frac{34,560}{5.66} = 6,190 \text{ pounds per square}$$

inch. This is seen to be less than either the tensile or compressive stress in the rod.

Coupling or side rods are subjected to lesser stresses from the piston than the main rods, for the reason that the force delivered to them through the main pin is divided up equally among all the wheels. In this case, if the engine has six wheels connected, there will be only one-third of the 45,800 pounds on the piston going to each wheel, or 15,266 pounds. Assuming the side rods to be of a rectangular section for illustration, and to be 1.5 x 4 inches, or an area of 6 square inches, the stress per square inch due to tension is equal to the $15,266 \div 6 = 2,544$ pounds, and putting the same test as before to determine its stability as a column, we find, as the longer rod of the two is 8 feet 6 inches long, that

$$S = \frac{P}{A}\left(1 + \frac{l^2}{q \times r^2}\right) = \frac{15,266}{6} \times \left(1 + \frac{102^2}{36,000 \times 0.187}\right) = 6,461 \text{ pounds.}$$

Centrifugal force due to a speed of 50 miles an hour, with drivers 56 inches diameter, the weight of the rod being 215 pounds, equals:

$$F = \frac{w\,v^2}{g\,r} = \frac{215 \times 961}{32.2 \times 1} = 6,456 \text{ pounds},$$

uniformly distributed.

Bending moment equals:

$$M = \frac{F \times l}{8} = \frac{6,456 \times 102}{8} = 82,314$$

inch pounds. The maximum fiber stress at the center of the rod will then equal M

divided by resisting moment of the section, $b\,h^2 \div 6$, and we have:

$$S = \frac{82,314}{4} = 20,578 \text{ pounds.}$$

This stress is far in excess of those due to tension and flexure, and approaches too near the elastic limit of the material for safety. The calculated stress is not, however, the actual stress, since no account was taken of the weight of the rod at the bottom of its path, which it is evident should be added to the centrifugal force. It is equally evident, too, that if the rod is to be assured of a reasonable length of life, the hight of it must be increased; this will also increase the weight, which must be kept down in order to decrease the centrifugal force, and to do this, it is plain the thickness must be reduced. This can be done, as we have seen that the stress due to compression is quite low as compared to the last. The I-beam section of rod would be the proper thing to introduce, however, to withstand the stresses in this case, rather than to alter the flat rod.

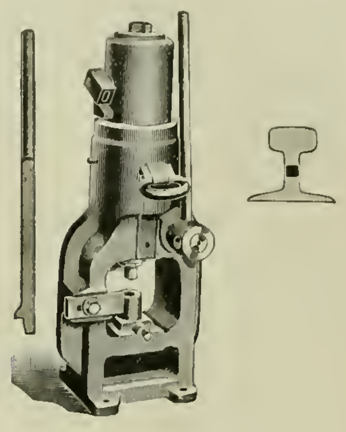
The rectangular sections and dimensions of same in the rods under discussion, are from actual practice on moguls now running. It is plain that these side rods are designed for lower speeds and will give good service under those conditions, but will not stand up under a repetition of the stresses due to speed assumed. The speed of 50 miles an hour, while not the regular thing in freight service, is sometimes made for short distances, and it was therefore considered in this case, to illustrate the range of stresses rods are subjected to.

The Cincinnati, Hamilton & Dayton have a novel car plant at Lima, Ohio, which is just being started up. The old shop was destroyed by fire, and the present shops built to supply the loss were started in June of this year. They comprise a coach-erecting shop, 100 x 200 feet; a mill, 100 x 120 feet, and a machine shop and engine room containing the electric and steam plants, 60 x 100 feet. The main engine is a Hamilton-Corliss of 250 horsepower, while the electric system is handled by a J. B. Allfree 13 x 12 engine, direct connected to a Triumph dynamo of 250 volts. This takes care of the lighting and transfer table.

A recent newspaper dispatch reads: "Five workmen of Homestead have just sold a jointly owned patent on a car coupler for $150,000. The men are Jacob E. Smith, a bricklayer; John Bower, a blacksmith; Louis Walker, a carpenter, and Thomas W. Morgan and Samuel Jack, laborers. Smith is the inventor and took the others in to defray expenses of the patent." We should like very much to see that car coupler. We think, however, that the words "just sold" should read "expect to sell." That means a big difference in the car-coupler market.

Closed Jaw Rail Punch.

This tool is built primarily for punching bolt holes in the web of 90-pound steel T-rails, and, unlike the tool generally used for this work, requires the rail to be punched before laying. The die is in a removable bolster, which can be changed to suit the rail being worked on.



The tool stands 2 feet 8½ inches high, and weighs 325 pounds, and has a power of 120 tons, with one man on the lever. It is a new tool and very compact. For further particulars address the Watson-Stillman Company, 204 East Forty-third street, New York City.

"Electric Street Railway History" is a very handsome illustrated pamphlet recently issued by the Westinghouse Electric & Manufacturing Co., of Pittsburg, Pa. This is the first part, and contains a review of the development of Westinghouse railway motors with reference to generating apparatus, and brief remarks on the possibilities of the future. It contains a beautiful engraving of the Westinghouse Electric & Manufacturing Company's Works, near Pittsburg, and pictures of dynamos, motors and other apparatus made by the company. Persons connected with electric traction will find this a very useful pamphlet.

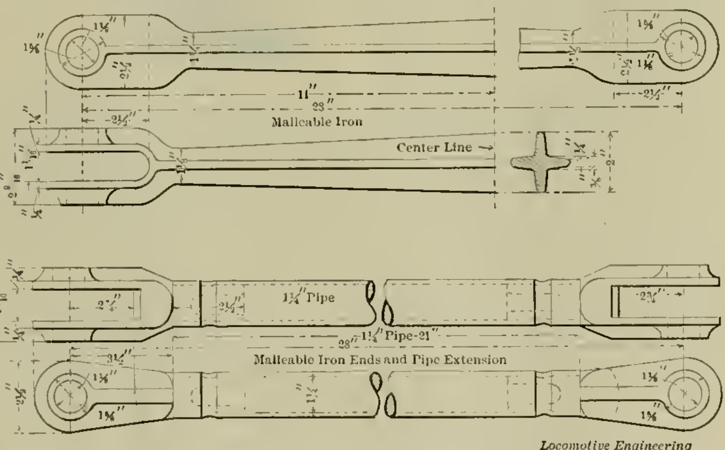
We have received from Secretary Cloud, of the Master Car Builders' Association, a copy of the Thirty-first Annual Report of the Railway Master Mechanics' Association. It is neatly bound in cloth and contains 287 pages of the standard size. The reports and discussions make very interesting reading for railroad men. The subjects that excited most discussion were: "Best Form of Fastenings for Locomotive Cylinders," "Best Method of Boiler and Cylinder Insulation," "Efficiency of High-Pressure Steam for Locomotives," and "Tonnage Rating for Locomotives." There were also good discussions on topical subjects, full reports of which are published in the report.

Malleable Iron Push Rods for Foundation Brakes.

The malleable-iron push-rods formerly used have given some trouble, and to remedy this Mr. Haskel, superintendent of motive power of the C. & W. M. and D., G. R. & W. roads, has substituted pipe connections between the malleable jaws, as is made quite plain from the drawings. The pipe ends are simply rolled into the grooves in the castings, and hold very firmly. They are also using malleable-iron brake levers, guides, bearings and clips; thus succeeding in reducing the dead weight by about 100 pounds and the cost $6 per car.

Early Baltimore & Ohio Sleeping Cars.

The management of the Baltimore & Ohio Railroad were among the first to enter into an agreement with George M. Pullman for the running of sleeping cars.



MALLEABLE ENDS ON BRAKE RODS.

Mr. Harvey Middleton, general superintendent of motive power, writing to this office on the subject, says:

"Along in the winter of 1870, there was an arrangement made by Geo. M. Pullman with the Baltimore & Ohio, to build six sleeping cars, which were constructed at Mt. Clare. These cars had ten sections, and a state room in one end, and were built with six-wheel trucks and heated by 'Baker' heaters.

"Immediately following the first six, there was a second lot of six built, which were known as 'open' sleepers, for the reason that they had no state room, in order to give additional room for two more sections, making twelve in all. This latter lot of cars was completed along in 1871.

"About two years after this, there were four more cars built, the same being 56 feet long and having twelve sections and a smoking room, and they were so well built that Mr. Pullman was very anxious to have the Baltimore & Ohio build all of his sleepers. Some of these cars are still in existence, being now in the emigrant service. The framing is in a very good state of preservation, owing, no doubt, to the very liberal use of paint, as the joints were put together with white-lead and the framing heavily coated before the sheathing and panels were applied.

"Just prior to the Baltimore & Ohio entering into building the first lot of cars, there was a lot of six received on the road, built by Jackson & Sharp, and were placed in service about July, 1870. It is believed that these were about the first Pullman cars built, and possibly this firm could give you considerable information regarding the same.

"Before the introduction of the Pullman cars on the Baltimore & Ohio system, there were some sleeping cars operated over the line by a company known as Knight, Myer & Others, consolidated. This company was a consolidation of nearly all of the sleeping cars in existence just prior to Mr. Pullman entering the field, and was composed of such sleepers as Knight, Myer and Woodruff. This consolidated company was, however, bought out by the Pullman company later. Their cars were rather crude, the upper berth being nothing more than a bunk hinged to the side of the car and covered with rattan. The bottom berth was made very much like the later cars, by an extension of the lower seats."

October 1st was Chicago Day at the Trans-Mississippi Exposition in Omaha, and all of the railroads ran special trains, carrying delegates of the different Chicago organizations attending. Among these was a special which left over the Burlington route, with the Cook County Democracy, and it was the longest train of Pullman cars that ever left Chicago on a regular run. It consisted of seventeen Pullman cars, one special private car, one baggage car and two engines.

One of our correspondents suggests that the Raub engine isn't rightly named, and that it ought to be "Robber." Perhaps there isn't so much difference after all.

New Passenger Equipment—Great Central Railway.

The new corridor trains, nearly completed, of the Great Central Railway, mark the advent of modern passenger cars more nearly in accord with best American practice in all details than has been hitherto used on English railways. The following extracts from "The Practical Engineer" show some very radical innovations over old passenger-train practice:

"These new corridor trains will be composed of seven vehicles, viz., brake (first), first-class, composite, two third-class, brake (third), with buffet car in center. The dining and luncheon trains consist of a brake (first), composite, first-class dining car, third-class, and brake (third). The carriages, which rest upon four-wheeled bogies, are fitted with Gould's vestibule and automatic coupler, and it may be added that the Great Central is the first of the English lines to introduce this ingenious but exceedingly simple method of coupling up the trains, which is effected automatically directly the carriages come in contact, whilst the uncoupling is operated by a lever at the side of the carriage, so that there is no necessity for the railway servant to get between the ends of the carriages, as is the general custom on English lines, either to couple or uncouple the carriages. The vestibule also acts as the buffer, but ordinary buffers and also the ordinary coupling are provided, in the event of the carriage having to form part of a train not fitted with the Gould patent vestibule and coupling. Gresham's direct system of heating, torpedo ventilators, the automatic vacuum brake, the electric communication between passengers and attendants form other portions of the fittings, and every effort has been made to reduce oscillation to a minimum.

"The first-class dining cars, third-class dining cars and the kitchen cars are lighted by electricity, and in addition to the usual lights, one is placed over each dining table; the rest of the cars are lighted by oil gas with Coligny lamps. The first-class dining cars are 50 feet long over platforms, each providing accommodations for twenty passengers. The internal fittings are sumptuous, and finished in rare woods, upholstered in figured plush, and embellished with works of art, the roof being decorated in gold and colors. The seats and tables are placed at the sides, with a passageway down the center. Over each table is placed the electric communication, and above are alcoves fitted with beveled-edge mirrors and brackets for holding bottles, glasses, etc. A hat-rack is provided over each seat back, and an umbrella-rack to each seat head.

"The third-class dining cars are externally of the same design, with the exception that they are 47 feet 6 inches long over platforms. These cars provide accommodation for thirty-six passengers. The interiors are finished in light and brown oaks, and have the same electric and table conveniences as the first-class dining cars; the ornamentation and finish being only a trifle plainer in character. The lavatories are placed at the ends, and a space is also provided for hand-bags. The kitchen car, which is placed between the classified dining cars, is 47 feet 6 inches long, and will, by means of connecting gangways, serve both classes of passengers. In addition to the kitchen and attendants' compartments, a special feature of this car is that it possesses two first-class private dining compartments, where the cooking is done by means of a gas range, and the kitchen is furnished with all necessary utensils, crockery, glass, cutlery, refrigerators, etc. The corridor carriages are externally of one uniform hight and design, their length being 46 feet 6 inches over ends, each being divided into compartments, with side corridors, which are lighted by large plate-glass lights, protected by neat brass hand-rails.

"The first-class carriages are finished in Spanish mahogany. In the corners are placed filters for the use of passengers, and at the entrance to the vestibules are hung doors with beveled-edge glass panels. Leading from corridor at each end are placed ladies' and gentlemen's lavatories, the floors of which are inlaid with mosaic tiles, and the walls covered with pegamoid and match-wood dado. The interiors of the compartments are trimmed in morocco, moquette, terra-cotta, Tashmere velvet and green cloth, finished in mahogany, and decorated with photos of places of interest on the company's system. The third-class carriages are of similar design, except that they are finished in polished teakwood, with lincrusta panels and dado. All the carriages are provided with portable tables fixed in position in any compartment as desired. The whole of the floors are covered with 'Kork' matting, and a rug is furnished, in addition, to each first-class compartment. The buffet cars are externally of the same length and design, and consist of a spacious buffet, with kitchen; three third-class compartments, attendants' compartment and lavatory—these being fitted and furnished similarly to the third class. The difference between the first and third class is but one of degree, passengers enjoying throughout perfect equality in all respects affecting comfort and welfare. Another special feature is that the company intends introducing a system of registration for luggage, which will be distributed in various portions of the train. All the first-class passengers' luggage will be placed exclusively in the brake attached to that portion of the train.

The third-class passengers' luggage will be similarly placed in the brake at the opposite end of the train, and passengers engaging private compartments will have their luggage in the same carriage. These trains have been designed by and built under the supervision of Mr. T. Parker, Jr., the company's carriage and wagon superintendent."

Wonderful Coincidence in Describing the Action of a Reversed Locomotive.

"The Inspector," of the *Railway Age*, has an eagle eye that no distorted statement or action in the railway world escapes. In a recent issue he tells the following story, and makes the deadly parallel that will be found to be amusing reading:

"When 'Omer smote 'is bloomin' lyre,
He'd 'eard men sing by land and sea;
An' what 'e thought 'e might require,
'E went an' took—the same as me."
—*Tommy Atkins.*

It is my personal opinion that the *Railway Herald*, published at 81 to 83 Temple Chambers, Temple Avenue, London, E. C., owes Mr. Angus Sinclair five shillings. That respectable, if not brilliant, journal has instituted a series of prize competitions and offers weekly "six prizes of 5s. each for the best original papers of not less than 450 words in length, upon any subjects of general interest to railway men of all grades, and of every department in the service." The competition is limited to bona fide railway employes. One of the prizes for the week ending August 6th was awarded to an essay entitled, "What happens inside the cylinders when an engine is reversed," from the pen of "A. N. S. Rwy. Engine Driver." The essay is apparently worth five shillings, and the award speaks well for the judgment of those who had the matter in charge.

In reading the essay as published, however, I noticed a trifling inconsistency, and consulted Sinclair's "Locomotive Engine Running and Management" for further light. I got it. But the subject of reversing is of such importance and the natural expectancy of a difference between English and American opinions so great that it seems worth while to give a side-by-side view of two comprehensive expositions of the subject from the two points of view. The prize essay and an extract from Mr. Sinclair's work follow:

WHAT HAPPENS INSIDE THE CYLINDERS WHEN AN ENGINE IS REVERSED.

(*By a N. S. Rwy. Engine Driver.*)

It is an easy matter to gain a fair understanding of the action of steam in an engine's cylinders during ordinary working, but it is a far more difficult matter to understand the operation performed in the cylinders when the engine is running in reverse motion. Before the engines were fitted with the present powerful steam brakes every engineman learned by experience that when the engine was reversed, even if no steam were applied, the action worked to stop the train, but just in what way this result came about was not very easy to understand. Some men, perhaps, have never tried to study the action, so we will follow the events of a stroke in reversed motion. Supposing an engine to be running ahead, and the necessity arose for stopping quickly, and the reversing lever was pulled into the back-gear position, when the crank is on the forward center, and therefore the piston at the front end of the cylinder, about to begin its forward stroke, the valve has the front steam port open a distance equal to the amount of the lead, but as the back-gear eccentric has been given full control of the valve, the latter will travel forward in the opposite direction to the piston, and the back-gear eccentric being in a position to impart a rapid movement to the valve, the front steam port will be closed immediately the piston begins to move. Having thus shut off all communication with the front of the cylinder, the receding piston creates a vacuum behind it. At the same time the back end of the cylinder being open to the exhaust, the piston pushes out the air freely up the blast pipe to the atmosphere. By the time the piston has traveled about 2½ inches of its stroke, the valve has reached the center of its travel, and passing that point it opens the front port to the exhaust, at the same time closing the back port. When this happens, the vacuum which has been created in the front end of the cylinder gets filled up with hot gases from the smoke box, and the piston draws air down the blast pipe into the cylinder during the remainder of the stroke. The back steam port is closed only during about another 3 inches of the piston stroke, while the lap of the valve travels over it. Then the back steam port being open to the steam chest, the piston during the remainder of the stroke drives the air before it into the steam chest and steam pipe. If this pumping action is continued it will eventually raise the air to a pressure higher than the steam pressure in the boiler, and will force back the double-slide regular valve, and rush into the boiler. The presence of air in the boiler often resulted in the injectors refusing to work until the engine had again been worked a few revolutions with steam, and the air had escaped.

The other strokes are merely a repetition of the one described. When the necessity arose to reverse the engine, it was perhaps a better plan to pull the lever full back than into the center notch, as was sometimes done under the impression of saving the engine from harsh usage. When the lever is fully reversed, the cylinders are merely turned into air pumps, but when put into the

WHAT HAPPENS INSIDE THE CYLINDERS WHEN AN ENGINE IS REVERSED.

(*From "Locomotive Engine Running and Management."*)

Many men who have a fair understanding of the action of steam in an engine's cylinders during ordinary working, have no idea of the operations performed in the cylinders when a locomotive is running in reverse motion. All men who have had anything to do with train service know that, when an engine is reversed, the action works to stop the train, even if the locomotive should have no steam on the boiler; but just in what way this result comes round they cannot clearly perceive. In hopes of throwing light upon this subject for those who have not studied it out, we will follow the events of a stroke in reversed motion, as we did in the ordinary working.

Supposing an engine to be running ahead, and the necessity arises for stopping suddenly, and the reverse lever is pulled into the back notch. When the crank-pin is on the forward center, and therefore the piston at the forward end of the cylinder, about to begin its backward stroke, the valve has the forward port open a distance equal to the amount of lead, as in Fig. 10. But, as the back-up eccentric has control of the valve, the latter is being pushed forward; and it closes the forward port just as the piston begins to move back. This shuts off all communication with the forward end of the cylinder; and the receding piston creates a vacuum behind it, just as a pump-plunger does under similar circumstances. At this time the back end of the cylinder is open to the exhaust, and the piston pushed out the air freely to the atmosphere. By the time the piston travels about 2 inches, the valve gets to its middle position; and, immediately after passing that point, it opens the forward end of the cylinder to the exhaust, and closes the back port. When this event happens, the vacuum in the forward end of the cylinder gets filled with hot gases, that rush in from the smoke-box; and the receding piston keeps drawing air into the cylinder in this way during the remainder of the stroke, and air from that quarter seldom gets in without bringing a sprinkling of cinders. The back steam port is closed only during about 2 inches of the stroke, while the lap of the valve is traveling over it. About the time the piston reaches 4 inches of its travel, the back steam port is open to the steam chest, and the piston forces the air through the steam pipes into the boiler during the remainder of the stroke. The forward stroke is merely a repetition of the backward stroke described.

When it is necessary to reverse a locomotive, it is a better plan to hook the lever clear back than to have it a notch or two past the center, as some men persist in doing, under the mistaken idea that they are in some way saving their engine from harsh usage. When the link is reversed full, the cylinders are merely turned into air pumps. When the links are put near the center, the travel of the valve is reduced; and the periods when the piston is creating a vacuum in one end of the cylinder, and compressing air in the other, are prolonged. The result is, that, when the exhaust is opened in the first case, the gases rush in violently from the center notch, the travel of the valve is reduced about 2 inches, and the periods when the piston is creating a vacuum at one end of the cylinder and compressing the air in the other, are prolonged, with the result that when the exhaust is opened at the front end, the gases from the smoke-box rush in violently, perhaps carrying in a cloud of fine ashes. At the back end the piston compresses the air in the cylinder so much that it jerks the valve off the face in trying to find an outlet. This is what causes the clattering noise in the steam chest so well known in cases where engines are run without steam and the reversing lever is kept notched up.

smoke-box, carrying a heavy load of cinders; in the other case, the piston compresses the air in the cylinder so high that it jerks the valve away from its seat in trying to find outlet. This causes the clattering noise in the steam chest, so well known in cases where engines are run without steam, while the reverse lever is near the center.

I cannot admit the suggestion that Mr. Sinclair during his present visit to England has entered this competition under the nom de plume of "A N. S. Rwy. Engine Driver." In that case he would not have made the error in copying which makes it a case of "you'll be d—d if you do and be d—d if you don't" hook up the reverse lever on the center notch, and which first led me to consult his published work. The essay is perhaps worth more than five shillings; but the *Railway Herald* should in any case pay Mr. Sinclair that amount (unless, indeed, it is satisfied that he and the N. S. Rwy. driver are identical), or republish the essay in quotation marks with the customary credit.

THE INSPECTOR.

Standards and Recommended Practice.

The following circular has been issued by Secretary Cloud, of the Master Car Builders' Association, and is given for the information of those interested in the revision of standards by letter ballot:

"The Standards and Recommended Practice of the Association as revised by the last letter ballot, and as they will appear in the proceedings of 1898 soon to be issued, can be had in pamphlet form at this office at 25 cents per copy after October 1st. The large sheets of drawings, 30 by 38 inches, on semi- transparent paper for blueprinting, will be modified as follows to conform with small revised sheets:

"Sheets M. C. B. 1, 2, 4 and 5 have had notes added without change of drawings.

"Sheet M. C. B. 7 has had drawing for axle of 80,000-pounds capacity car added to it.

"Sheets M. C. B. 8, 9, 13, 14 and 15 made new.

"Sheets M. C. B.—C, D, G, H, I and J made new.

"Sheets M. C. B. 3, 6, 10, 11, 12, A, B, E and F unaltered.

"Any of these sheets may be had at this office at 25 cents per copy after October 15th.

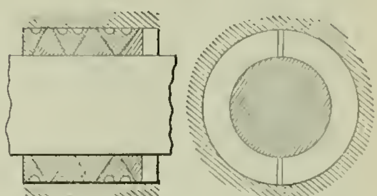
"The revised Air-Brake and Signal Instructions shown in Appendix A of the Recommended Practice have been published separately, same size as formerly, and uniform with the Rules of Interchange, as already announced.

"The revised Rules for Loading Long Materials shown in Appendix B of the Recommended Practice will be published in pamphlet form, 6 by 9 inches, and will be ready for distribution after October 1st.

"The Air-Brake and Signal Instructions and the Rules for Loading Long Materials are sold separately, each at the same price as the Rules of Interchange, viz.: 25 copies, $1.00; 50 copies, $1.75; 100 copies, $3.00; single copies, 5 cents."

A New Throttle Stem Packing.

Although but just put on the market, the Keystone packing has been tested for some time—five years in one case—and has proved its worth. It is not intended or expected to replace the regular metallic packing on general work, but solely for throttle stems, or similar places


Locomotive Engineering

KEYSTONE PACKING.

where there is no vibrating motion. It is easily applied to an ordinary stuffing-box and effectually prevents leakage, while allowing an easier working throttle than with soft packing. It is made by the United States Metallic Packing Company, Philadelphia, Pa., who are well known in the packing line.

President J. W. Duntley, of the Chicago Pneumatic Tool Company, has just returned from a somewhat extended trip to the Pacific Coast, extending as far as Victoria, B. C., and has met with the most flattering success in the introduction of tools and securing new orders. Owing to the large amount of business developed by him, the company have decided to open an office in San Francisco for the convenience of their patrons, and will be represented by Mr. Henry Engles, No 537 Mission street, San Francisco. Mr. Duntley reports business on the Coast as expanding in his line, and the demand for pneumatic tools and appliances, including various sizes of piston air drills, pneumatic hammers, riveters, etc., is beyond expectations.

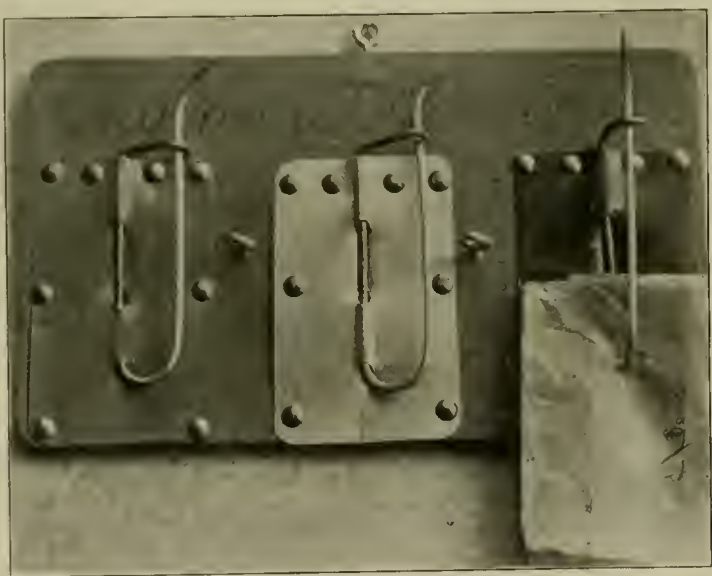
Engineer's Order File.

The engraving shows a new order file for engineers which has been recently put on the market by Mr. Amos McKanna, of Emporia, Kansas.

The left-hand file is on a blue sheet of tin and is intended for "Slow" orders, as for bad track, unsafe bridges, etc.

The right-hand file is on a red tin, and is to be used for orders that are to be first carried out, such as "Meet" and "Pass" orders.

The center file is white. When order is carried out, take it off other file and place it on white file. Also use white file for checks of the train register and clearance checks. This will keep orders separate and safe, and you can get them at once. It will also prevent the tearing of orders, and is intended in general to save trouble, life, property, and incidentally the engineer's job.



McKANNA'S ENGINEER'S ORDER FILE.

Mr. McKanna reports that they are being used on several roads in the West, and that they seem to be well liked.

Work of Young Men's Christian Association Among Railroad Men.

Concerning the work done by the Young Men's Christian Association among railroad men, a recent report by the International Committee says:

"There is no more important body of working men than the railroad men, of whom there are over a million in the United States and Canada. The Young Men's Christian Association is the only Christian organization doing an extended religious work among this large and important class, and also furnishing reading rooms, bathrooms, libraries, social rooms and, in many cases, restaurants and sleeping accommodations. There are one hundred and thirty railroad associations, with a membership of over thirty thousand, and employing one hundred and forty-five secretaries. They own twenty-nine buildings worth nearly four hundred thousand dollars, and control twenty-two other buildings worth two hundred thousand dollars, erected or set apart by railroad companies for their use. The work is done by railroad men themselves, while companies owning over one-half the mileage of American railroads contribute one hundred and fifty thousand dollars a year towards the support of local associations on their roads. This fund represents the interest on three million dollars at five per cent., and is practically an endowment contributing towards the stability of these associations. But, on account of their unusually difficult and changing circumstances, they would probably pass rapidly out of existence if the steady, watchful oversight of six secretaries of the International Committee were not given to them. The corporations rarely contribute to this work of supervision."

"Cambria Steel" is the title of a book of 350 pages sent out by the Cambria Iron Company, of Philadelphia to their friends and customers. It constitutes a first-class book of reference for everythi g relating to steel and iron. Every engineer having anything to do with iron and steel in any form cannot fail to find this a very valuable book of reference.

The four new charts which will be given with next year's paper, will be most interesting and instructive to any live railroad man. The first will probably accompany the January issue.

LOCOMOTIVE ENGINEERING
A PRACTICAL JOURNAL of RAILWAY MOTIVE POWER AND ROLLING STOCK.

Vol. XI. NEW YORK, DECEMBER, 1898. No. 12.

Lehigh Valley's Latest Consolidation Engine.

The tendency towards designing extraordinarily large locomotives for special purposes where great power is requisite is very well illustrated by the Lehigh Valley consolidation engine here illustrated, which was recently built by the Baldwin Locomotive Works for the railroad named. The engine is a Vauclain compound with cylinders 18 and 30 x 30 inches, and is intended as a pusher on one of the heavy grades on the Lehigh Valley Railroad. It will be seen from the cylinder dimensions that one side alone would make an engine more powerful than the average locomotive.

The boiler pressure carried is 200 pounds to the square inch, which gives a tractive power of about 55,000 pounds. Enormous heating surface is provided, the firebox alone giving 215 square feet, and the tubes 3,890.6 square feet; a total of 4,105.6 square feet—more than double the heating surface provided for common heavy consolidations. The engine is guaranteed to pull a train weighing 1,000 tons, exclusive of weight of engine and tender, up a long grade 61 feet to the mile at a speed of 17 miles per hour. This duty will be easily done, and leave a good margin of power for bad weather and mistakes in tonnage rating. An unusually protracted pull has to be made without stopping for water; and to enable this to be done with certainty, a tank of 7,000 gallons has been provided. This is the largest locomotive tender we ever heard of. The weight of the water alone will be over 58,000 pounds, and the tender empty weighs 45,250 pounds. This combined weight will put considerable strain upon the two Fox pressed-steel trucks which carry it. Annexed are a few of the leading dimensions:

A CONTRAST.

Cylinders:
- Diameter—High pressure, 18 inches; low pressure, 30 inches.
- Stroke—30 inches.
- Valve—Balanced piston.

Boiler:
- Diameter—80 inches.
- Thickness of sheets—⅞ inch.
- Working pressure—200 pounds.
- Fuel—Hard coal.

Firebox:
- Material—Steel.
- Length—120 inches.
- Width—108 inches.
- Depth—Front, 62⅝ inches; back, 60⅛ inches.
- Thickness of sheets—Sides, ⅜ inch; back, ⅜ inch; crown, ½ inch; tube (F.), ¾ inch; tube (B.), ½ inch.

Tubes:
- Number—511.
- Diameter—2 inches.
- Length—14 feet 7¾ inches.

Heating Surface:
- Firebox—215 square feet.
- Tubes—3,890.6 square feet.
- Total—4,105.6 square feet.
- Grate area—90 square feet.

Driving Wheels:
- Diameter, outside—55 inches.
- Diameter of center—49 inches.
- Journals—9 x 12 inches.

Engine Truck Wheels:
- Diameter—36 inches.
- Journals—6 x 12 inches.

Wheel-base:
- Driving—15 feet.
- Total, engine—23 feet 10 inches.
- Total, engine and tender—55 feet ½ inch.

Weight:
- On drivers—202,230 pounds.
- On truck—22,850 pounds.
- Total, engine—225,080 pounds.

Locomotive Efficiency and Capacity.

(Second Paper.)

BY C. A. SELEY.

For some years past, railroads have had a pretty heavy dose of "economy," so called. It was no doubt necessary, and in many cases wisely administered, and some very good lessons have been learned that will probably prevent much of the wide-open policy that was quite common in some quarters. In many cases, however, the evidence of the economy was found mainly in the pay-rolls and clipped requisitions. If the lesson of the past is well conned, the true economist will look to the mechanical engineer in order to bring his power up to date in efficiency and capacity.

To do this we must consider thoroughly the importance of every pound of mean effective pressure in the cylinders, the size and shape of every opening and passage from the throttle to the top of the stack—all in the light of the latest knowledge and experiments. For example, the Master Mechanics' Association experiments have given a design of exhaust column which will not only assist in producing a maximum draft effect, but the writer has found that it will make less back pressure than is the case with many patterns of column. We have far more accurate knowledge of front-end conditions than formerly, and by this arrange stacks, exhaust pipes and tips, and have suitable draft and minimum back pressure. When we consider that the saving or reduction in back pressure is really an increase in the mean effective pressure of the same amount, the importance of properly caring for the exhaust becomes apparent. Just as much steam must be exhausted from the cylinders as enters them, and by more twists and turns than are made in entering. This matter is ably treated in an editorial in the January, 1897, LOCOMOTIVE ENGINEERING.

We are now cutting back the edges on the exhaust side of the valves where former practice favored a lapping over so as to retain the exhaust. Formerly lead of from 1-16 to 1-10 inch was given the valves, regardless of the length of the blade or other proportions; but we have come to the adoption of a certain lead which will give the best results in the running positions of the valve gear, and we give full gear lead no consideration, except as a starting point for obtaining proper lead in the running notches.

The link motion so common on American locomotives is very simple when compared with the motions in extensive use in Europe; but, in fact, its actions are very complex, and not as thoroughly understood as might be expected after these years of use. What were really supposed to be disadvantages, such as the increasing lead, etc., have proven to be of greatest value. One can watch the valve motion of a Corliss or other type of stationary engine almost with fascination as it responds to the demands of the load, yet keeping up a constant rate of revolutions.

Few have had the opportunity of watching the valve motion of a locomotive perform all its various functions. Just follow with your mind's eye, if you please, and note the action of a link motion in full gear, imparting a long, slow stroke to the valves; now think of the links being raised so that the block is near the center of the link. One would think, to watch a link working in this position, that there could be no regularity in the motion imparted by such an irregularly moving object; but notice the valve stem, or listen to the exhausts—if, indeed, you can distinguish them, for this motion is often called upon to distribute the steam to pistons traveling a thousand feet per minute, cutting-off the steam at quarter stroke, perhaps. The steam ports are but partially uncovered; but it is enough, and in the fraction of a second the steam is in and out again up the stack. Say we encounter a grade and the watchful engineer drops the lever a notch. Instantly the valve is given a little more travel, the ports are a little more opened, more steam is admitted and the mean effective pressure in the cylinder a little higher, therefore more power is exerted. No matter what the speed, the link will respond to the lever, and although its motion is seemingly so erratic, the valves travel true, and so distribute the almost vital forces which go to make the locomotive almost a thing of life.

But an engineer says, "How is it when my engine gets lame?" Alas! all engines do not work as finely as the one I have been thinking of, and if they do on the start, the inevitable wear will in all probability in time bring about an unevenness in the valve motion, producing lameness.

An engineer said to me, "My valves need squaring up; it takes an extra notch to make time on Colby Hill, and my coal record will not stand it." It took a very slight adjustment to correct the irregularity and restore the desired efficiency.

The point of this tale is, that lame engines are not coal-savers, and this is of greater importance to the company than to anyone else, and particularly so in these days of pooled engines, when no one is particularly interested in getting their best performance. When engines are running from 3,000 to 5,000 miles per month, it would be a paying investment to have valves squared up every month or two. This can best be done with the indicator, at a minimum cost of time and trouble, and if systematically carried out, will result in great saving, give valuable information and keep the power up to best efficiency. It is now approved practice with many roads to shop engines so soon as they are incapable of doing very good work, instead of waiting for them to actually fall down.

The boilers have changed more in appearance and proportion than any other feature of our locomotives. The enormous quantities of steam required for modern train service, which includes not only that for the engines, but for air pumps, heating, and in some cases lighting of trains also, have produced the fine types of boilers now in use. The firebox now scorns the limitations of frames and axles and leaps right over them, giving grate areas that will burn coal at a fairly economical rate per square foot.

Higher pressures have brought about improved design in the seam riveting, bracing and staying, and in the quality of the material employed in the construction. Extended wagon tops and large shells have increased water and steam storage. We can only say, however, that these modifications have largely increased the boiler capacity, while the efficiency on the whole has not been greatly increased, except in so far as the large fireboxes permit a more perfect combustion in the box. The relation of the volume of the box to the enclosing area of heat-absorbing surface will explain this. The ability to produce steam of higher pressure is of course a gain, and the greater storage will often show a gain by taking a train over a grade which might otherwise reduce the rating over a considerable distance.

The conclusion would therefore be, that the locomotive engine of to-day owes to the boiler whatever additional efficiency can be claimed over its predecessors, and for this reason it would be difficult to bring many of the old-time engines up to date with their present boilers. When frames are heavy and machinery well designed and of suitable size for the contemplated duty, then a new boiler of proper capacity will be a good investment. The old ones need not necessarily be scrapped; but even that should not stand in the way if otherwise good engines have to be forced in duty to a point where they are badly deficient in steam. Steam is the great desideratum, for a poor engine with plenty of steam can get over the road, while a good engine with insufficient steam at a critical point may be the cause of very expensive delays.

The introduction of the big 80 and 100 ton freight and passenger engines has made necessary a revolution in wrecking machinery, turntables and machines required for handling the boilers in the shops. When one of the big new monster engines leaves the track the cranes now in use and the tackle that was sufficient to move the smaller engines are entirely inadequate to the work of lifting the heavier machines. The Pennsylvania has had to provide larger cranes and stronger turntables, and they are now preparing plans for huge wrecking cranes which will be sufficiently powerful to manipulate the great locomotives that have recently come into use.

The Finland Locomotives.

We were unable to secure a photograph of these engines in time for the last issue, but as they are rather novel, we show two views, one in the cab.

The other view needs little explanation, but there are several features of the cab arrangement that are different from our practice.

There is a Pintsch light in the cab, the bottom of the globe just being visible. The gages are not of our pattern, and in fact the only American fitting is the lubricator, a Nathan. The flange joints, the wheel on the reversing screw, etc., indicate a foreign engine.

The throttle is also interesting. The stem passes down through the stuffing box shown, and has a young crank on the end, in the sort of a box that is bolted to the boiler. From this a rod runs to a bell crank beneath the dome, and a rod from this moves the throttle valve itself. This was indicated in outline in the elevation of the engine shown last month.

The Richmond Locomotive Works are finishing up the last of the lot.

Setting His Valve.

The night foreman had been squaring up the valves on the "193" for Peter Rafferty, one of the best freight engineers on the road; but, by some mistake—one of those kind that nobody knows anything about—she was worse than ever the next morning.

Peter took her over the road with her valves sawing off small chunks of steam in three out of the four exhausts, but the fourth sounded like a bass drum coming in on the chorus.

Pete was rather wrothy when he came back, but he kept his temper to himself as the night foreman asked him how she went.

"Foine, Misther Jackson, foine. Niver heard anything loike it. But, say, Misther Jackson, if yez will jist fix the other tree exhaust like that *wan*, the 'Wan ninety-tree' will pull more cars than eny engine on the road."

Notes from Meadville—Drop Pits, Boring Mill Work, Drinking Water.

The Erie shops at Meadville have some points of interest not common to railroad shops in general, and a brief mention of them will serve to show how attention to small things may be productive of results and tend to a smooth movement in the aggregate. Of course, proper original design of a shop plant is the most important factor in attaining such ends, but the minor details cut a no mean figure.

In one particular the erecting shop would attract the attention of the mechanic, by reason of its very novel arrangement of tracks and pits, there being a double line of these extending the length of the shop, both under one roof, but having a wall between, as though in two separate shops, although the tracks are continuous from one pit to the other. The advantages of such a system of pits for stripping or putting on the finishing touches to an engine are obvious enough to not need enlarging on here.

The drop-pit question is solved in a way that looks highly satisfactory to all whose shop experience has included a wide acquaintance with jacks in getting an engine on the blocks. This drop runs practically the whole length of the shop, taking in all of the inner line of pits, and requires several of the usual four-wheeled carriages with rams, which are raised and lowered by air. It is the most complete drop arrangement to be found anywhere.

It is no longer an uncommon thing to find a boring mill engaged on work that never entered the brain of the designer of the tool as among its possibilities as an auxiliary to the planer, but in these shops the mill stands easily first on many jobs that have been considered strictly the property of the planer. On plain surfaces of work requiring sizing to thickness, such as removing stock on the sides of driving boxes, or wedges and shoes, the tool has been made to give excellent returns, because the table could be filled with work, and the two tool heads be brought into operation. The finishing cut being started after the roughing cut was about half over the surface, the time to do the job may be summed up in that required to rough out the work alone. The continuous circular cut of the mill, as against the reciprocating action of the planer, explains the economy of the former over the latter.

Potable water is very often regarded as a matter of small consequence in a railroad shop. We are all familiar with the tub which was filled in the morning and waited for the dry crowd to empty it, while generally open to receive anything dropping in its vicinity. Here the drinking water is made cool by means of coils of ¾-inch pipe, which are simply a continuation of the water system; the coils being placed in ice boxes under the shop floor. The pipes are placed at intervals through the shop, convenient to every-

FINLAND STATE LOCOMOTIVE, BUILT BY RICHMOND.

body, and giving a delightfully cool drink to a parched palate. This must necessarily be a time-saver in hot weather, since the water is within easy reach of all. Master Mechanic Donahue thinks it is as good a thing as he has done.

Tabulated Axle Data.

The accompanying table of axle dimensions of passenger train cars and tenders, together with the type of car, capacity, weight and the resulting fiber stresses at center, hub and journal, furnishes information that is an exceptional thing to find in the average railroad drawing office. The uses and value of such a table are obvious to anyone that is interested in axle design, since it shows at a glance what the fiber stresses are when the axle is new and also when the journal has reached the limit of wear assigned to it. In addition to this, a moment's time only is required to determine what capacity of lighter car an axle may be applied to for further service, after having reached its limit of wear in service under the original car.

A table of this kind should not be a rarity in a drawing office, even if time is a factor in its make-up that is hard to get. There are few but will concede that is a good thing to have. This table, for want of space, shows only the passenger equipment, while the print from which the data is derived shows the freight as well as passenger. In the calculations, there is a certain percentage added to the capacity of the car to provide for overloading, as will be seen over the capacity column. The calculations were made by Chief Draftsman Posson, of the Northern Pacific machinery department, who used Reuleaux formula for finding the bending moments and their resultant stresses.

Terminal Shop Notes.

The Terminal Railroad Association of St. Louis is a sort of clearing-house in the affairs of all the roads doing business over the Eads Bridge, and is therefore an organization wielding the greatest influence in handling freight entering and leaving the city. As necessary factors in the transaction of this business, an equipment of forty-five six-wheel connected engines is required, together with a shop plant for the upkeep of the rolling stock—in fact, all the adjuncts going with the machinery department of a good-sized road. From the appearance of the plant, it is at once seen that the old story of small beginnings and the failure to keep pace with the demands of a growing business, would place this shop in the list of those that could not do work on economic lines. This view is a natural one, when it is understood that, besides keeping up their own equipment, the company does considerable outside work for roads in St. Louis which have only roundhouse facilities for doing repairs. For these reasons, ability of a no mean order is required in the head of the department, and the power shows that it is not suffering from want of the right kind of attention.

In this shop a new use has been found for compressed air. The steam hammer in the blacksmith shop is run with it constantly, and the same is also used in the shop engine at times, when for any reason it is desirable to do so. The shafting for the wood-working tools is driven by an electric motor. The air and electric service of the company is among the best we have seen, for the reason that the demands made by the Union Station for electricity and air make it imperative that

Number	Length of Car	Capacity of Car.	Weight of Car.	Axle No.	Size of Journal.	C to C of Jour.	Weight or Total Load per Axle.	Moment at Hub.	Moment at Center.	Moment at Jour.	22,000 lbs. fiber stress d at hub should be.	22,000 lbs. fiber stress d at center should be.	11,000 lbs. fiber stress d at journal should be.	Fiber Stress at Hub. Original.	Fiber Stress at Hub. Limit.	Fiber Stress at Center. Original.	Fiber Stress at Center. Limit.	Fiber Stress at Journal. Original.	Fiber Stress at Journal. Limit.
VESTIBULE PASSENGER COACHES.		20%.																	
21	50′ 10″ Oriole	7,800 lbs.	64,900 lbs.	1	4″ x 8½″	6′ 6″	20,000 lbs.	276,634	176,887	51,250	5.03″	4.34″	3.60″	5″ diam. 22,536	4⅞″ diam. 24,315	4⅜″ diam. 21,511	4⅛″ diam. 25,673	4″ diam. 8,160	3⅝″ diam. 10,956
21½	69′ 6″ Dining Car	7,500 ″	101,100 ″	1	4″ x 8½″	6′ 6″	19,550 ″												
21¾	6′ 6″	7,500 ″	98,050 ″	1	4″ x 8½″	6′ 6″	19,739 ″												
BAGGAGE CARS.																			
22	50′ 10″	10% 40,000 lbs.	61,000 lbs.	D. 6. 1	4″ x 8½″	6′ 6″	29,975 lbs.	414,607	254,485	76,810	5.76″	4.9″	4.14″	5″ diam. 33,766	4⅞″ diam. 36,441	4⅜″ diam. 30,947	4⅛″ diam. 36,920	4″ diam. 12,221	3⅝″ diam. 16,420
23	50′ 10″	40,000 ″	60,000 ″	2	4″ x 7″	6′ 3″	29,664 ″	387,270	238,586	63,036	5.63″	4.79″	3.87″	5″ diam. 31,549	4⅞″ diam. 34,033	4¼″ diam. 31,649	4⅛″ diam. 34,617	4″ diam. 10,029	3⅝″ diam. 13,501
23½	50′ 10″	40,000 ″	61,000 ″	4	4¼″ x 8½″	......	29,975 ″	414,607	264,510	76,810	5.75″	4.95″	4.14″	5⅜″ diam. 27,118	....	4⅝″ diam. 28,562	....	4¼″ diam. 10,189	
ENGINE TENDERS.																			
24	E. 1	20%. 46,884 lbs.	28,916 lbs.	2	4″ x 7″	6′ 3″	24,461 lbs.	309,358	189,389	51,977	5.23″	4.45″	3.63″	5″ diam. 24,387	....	4¼″ diam. 25,124	....	4″ diam. 8,270	
25	F. 2	53,352 ″	36,648 ″	See Tender Axles	4″ x 8″	6′ 5″	29,656 ″	399,267	248,090	74,140	5.69″	4.86″	4.10″	5¼″ diam. 28,099	4 13/16″ diam. 36,479	4⅞″ diam. 22,000	....	4″ diam. 11,800	
26	E. 5	45,277 ″	34,443 ″	3	4¼″ x 8″	6′ 3″	25,677 ″	325,160	201,996	64,192	5.30″	4.54″	3.91″	5⅝″ diam. 21,336	....	4⅝″ diam. 21,811	....	4¼″ diam. 8,118	
27	D. 3	42,555 ″	28,335 ″	See Tender Axles	4″ x 8″	6′ 5″	28,335 ″	309,164	192,169	58,824	5.22″	4.46″	3.77″	5.22″ diam. 22,135	....	4.46″ diam. 22,059	....	3.77″ diam. 11,180	
SLEEPING CARS.																			
28	69′ 6″	7,500 lbs.	99,000 lbs.	1	4″ x 8½″	6′ 6″	19,109 lbs.	281,131	180,202	50,161	5.06″	4.36″	3.58″	5.06″ diam. 22,098	....	4.36″ diam. 22,139	....	3.58″ diam. 11,133	

the plant should be first class in this regard.

There is a project on foot at this time to build and equip a plant in accord with the requirements of the increased business. Shop visits are never without interest or results to the old-time shop graduate, if he has not set up the obsolete practice of his youth as an idol to worship in these days when a good or poor shop equipment bears such an intimate relation to profit and loss. A modern shop with the present management behind it would be a money-maker for the Terminal Association, and the fact that they are going to build shows they understand the situation.

Flue Work on the Milwaukee Road.

The distortion of flue sheets due to excessive rolling has never been thoroughly understood, we believe, and is not now very clear to the average mechanic; but it is no mystery to the Milwaukee road at Dubuque, for they have on exhibition at those shops an object lesson in the shape of an old flue sheet which was removed for the reason that the flue holes more resembled the eye of the meek Mongolian than a true circular form. Some of these holes, by our measurement, were 2 7-16 inches on the major axis by 2 inches on the short diameter. This elongation of the hole was at an angle of about 45 degrees with the sheet, and the distortion of the holes was continued in the sheets at the sides and top, and caused cracks to show at the unions where rigidity prevented any further movement.

It required some sharp investigation to assign a cause for this action, and numerous experiments were necessary before final satisfactory results were obtained. The means taken were of the most ingenious character, among which were the scribing of concentric circles from the center of the flue sheet before expanding the flues, and noting the distortion after expanding. It was found that the sheet was 5-16 inch longer in the vertical plane, and ⅛ inch longer horizontally after expanding the flues than before.

This was the information sought and the cue for action in devising an expander that would leave the flue sheet in its original shape and without internal strains. An expander roller with its center of a smaller diameter than the ends, was found to accomplish that result, and was discovered to have the advantage of rolling a flue to any degree of thinness without altering the shape of the holes in the least.

In the reduction of cost of flue repairs, the improvement in shop methods of doing the work is so markedly small and inexpensive as compared with those in which antiquated means are followed, with a resulting high price on the output, that the query is a pertinent one as to why the badge of drudgery should have continued prominence and nudge system to the rear. In this connection, and having a close bearing on a cost in the near vicinity of two cents per flue for the actual work done on flues, which does not include removal or replacing, may be mentioned the fact that the heating is done in a forge that has a wrought-iron screen hanging before it, and which is kept wet and cool by a perforated pipe, making one of the finest humanitarian kinks ever devised for the comfort of a shop man. The welding is done on a revolving welder; but the third roller has been applied to the machine by General Foreman Miller, who has also devised some ball-bearing swaging tools for outside and inside of a flue—tools that give marvellous results, measured by speed and quality of the work.

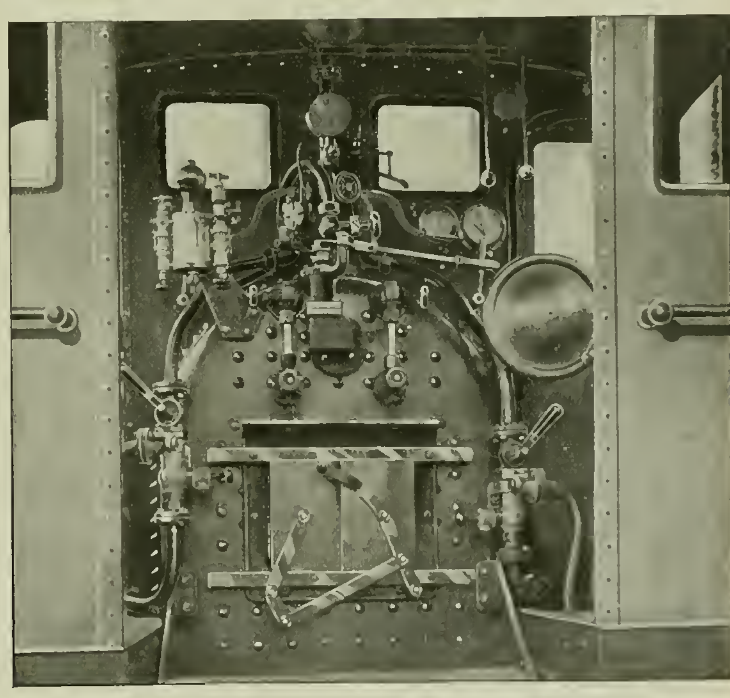
The Sand Blast on Tenders.

To obtain a proper foundation for the priming coat of paint on locomotive tenders, the sand blast is used by Superintendent of Motive Power Quayle at the Chicago shops of the Chicago & Northwestern Railway. A small building dedicated to this purpose has been erected between the tank shop and paint shop, into which the tender is placed after shopping, and is then subjected to the sand blast, which leaves a beautiful clean raw surface well adapted to seize and hold any applied pigment. The condition of the surface necessitates immediate action with the brush, else oxidation would leave the metal in as bad a condition as before cleaning.

The sand used for the cleaning operation is elevated by air to a reservoir located on the roof of the building, from whence it falls by gravity through a rubber hose to a ¾-inch pipe, which directs the sand to its work. This pipe is connected to a "T" which has a reduced air nozzle passing by the opening of the hose, on the ejector principle. By this means the sand is prevented from cutting out the hose, for the reason that the air pressure carrying the abrasive against the work cannot enter the hose, it being operative only through the horizontal iron pipe extending from the "T" connection. All sand used drops through the open floor into a receiver below, from which it is again elevated for further use.

An Air Hammer.

The prediction that compressed air had a field practically limitless in the railroad shop, was no idle one. In recent shop explorations we have found air utilized in ways entirely new, and these channels open up another line of possibilities which in time reveal others and assist in welding the links of an endless chain. One instance in point is that of an air hammer in the blacksmith shop of the Chicago, Rock Island & Pacific, at Chicago. This hammer is the outcome of a need for a way to jump broken frame jaws on, and it does the job perfectly. An ordinary wooden jib crane constitutes the frame for the hammer, which is simply an air cylinder rigidly fixed to the crane, with the piston extending downward and fitted at its lower end with a hammer head. On work requiring considerable head room and clearance at the floor, this hammer is pronounced a good thing.



INTERIOR OF CAB, FINLAND STATE RAILWAY.

Fads and Fancies in Locomotive Building—No. 12.

We wind up our "freak" series with the last, but not least, of these alleged improvements. This engine dates back several years, but has had intermittent fever, the last violent attack occurring about a year ago. The scheme is not a new one by any means, as men have been trying to "get something for nothing" for centuries, in mechanics as well as in finances.

The engine shown (for there have been several built—more than falls to the lot of most ideas as freaky as this) was said to have been built for the South Jersey Railroad in September of last year. In reality, Mr. Holman (or rather the stockholders) paid for the engines, and the road mentioned merely gave permission for the use of their name and tracks to enable the engines to be run. Few roads would even allow this privilege.

The engine had 20 by 26-inch cylinders (rather large for a small road), 63¼-inch drivers; total weight, including the whirligig time-beaters under the drivers, 161,000 pounds.

Needless to say, they have not been adopted by any of the leading roads, and it will probably be an even race between this and the Raub (shown last month) for the prize of being the greatest freak.

Locomotives for Anthracite Coal.

The use of anthracite coal in locomotives dates back more years than most people imagine, and many of the early experiments are interesting. In 1833 Col. Long tried it on his engine, "Black Hawk," running on the Philadelphia & Germantown Railroad, in competition with "Old Ironsides," Baldwin's first engine. Col. Long was very enthusiastic over what appeared to him a success; others saw it differently.

The next step of which we have record is an engine by Eastwick & Harrison, the "Samuel D. Ingham," on the Beaver Meadow Railroad, in 1835. There was nothing peculiar in this engine, and the work required of it would not be considered satisfactory at this time. Another step was taken by the same firm when building an engine in 1839 for the Philadelphia & Reading Railroad, with a guarantee of using anthracite coal for fuel. This engine (Gowan & Marx) had an unprecedented length of firebox. It was 5 feet long, and the rear driving axle was placed under it. The boiler was of the "Bury" pattern. This engine's record is wonderful for efficiency. It had a jet of live steam in stack to help the draft when standing, and is believed to be the first blower used on locomotives.

The next advance we find is in 1847 by Ross Winans, with his "camel" engines, four of which were placed upon the Philadelphia & Reading Railroad, with the firebox 5 feet long and 3½ feet wide, placed entirely behind the wheels. The engines proved beyond a doubt that the coal traffic of that road could be handled with anthracite coal for fuel. The only change made in this type of engine was that the later engines had longer fireboxes until they reached the length of 7½ feet. The last engines were free steamers.

In 1852 we find Mr. Milholland patenting a boiler for anthracite coal of nearly the same form as the Ross Winans' "camel," except he uses two sets of flues, and a combustion chamber in the central part of boiler, but after a dozen or so were built the use of the combustion chamber was abandoned.

In 1853 M. W. Baldwin & Co. built for the Mine Hill Railroad an eight-wheel coupled engine and made a shallow firebox, and extended it back over the rear driving axles. This firebox was 7½ feet long by 3 feet wide. The outside of this boiler was of usual form, having a wagon top practically the same as now in use. This seems to be the first that is called the long firebox.

Zerah Colburn in 1854 designed some engines for the D., L. & W. R. R. for anthracite coal, and, to get the grate area needed, the firebox was placed entirely behind the rear drivers and extended out to 7½ feet in width. They were originally 4½ feet long, and were finally lengthened to 6 feet. These engines were fair steamers, but were unsteady and hard on the roadway on account of short wheel-base and long overhang at each end.

In 1856 L. Phleger patented a boiler which had water tables, combustion chambers, water bars for grates, and which extended over rear driving axles. It was a fair steamer, but the cause of its death was the complication of "good" features.

Danforth, Cooke & Co., in 1857 built two engines for the D., L. & W. R. R., using the Colburn firebox, but lengthening out cylinder part of boiler and placing a four-wheel truck in front of drivers. This made a steady running engine, easy on roadway, and had only one weak point, and that was the coupling of engine to the tender. This was the same as used by Winans and all of the overhung firebox engines. For freight traffic these engines were excellent. We find that in the latter part of the same year (1857) Millholland brought out his new type of passenger engine, "Vera Cruz," using anthracite coal. This had a shallow firebox, brought back over rear driving axle, making it 7 feet long and 3½ feet wide, resting it on top of frame, which was made sloping from rear pedestal towards the front one, the first "toboggan" frame on record. Water tubes were used for grates, and were connected direct to water space of firebox. This engine proved entirely successful, and there were many made of its class, of which some are yet doing good service.

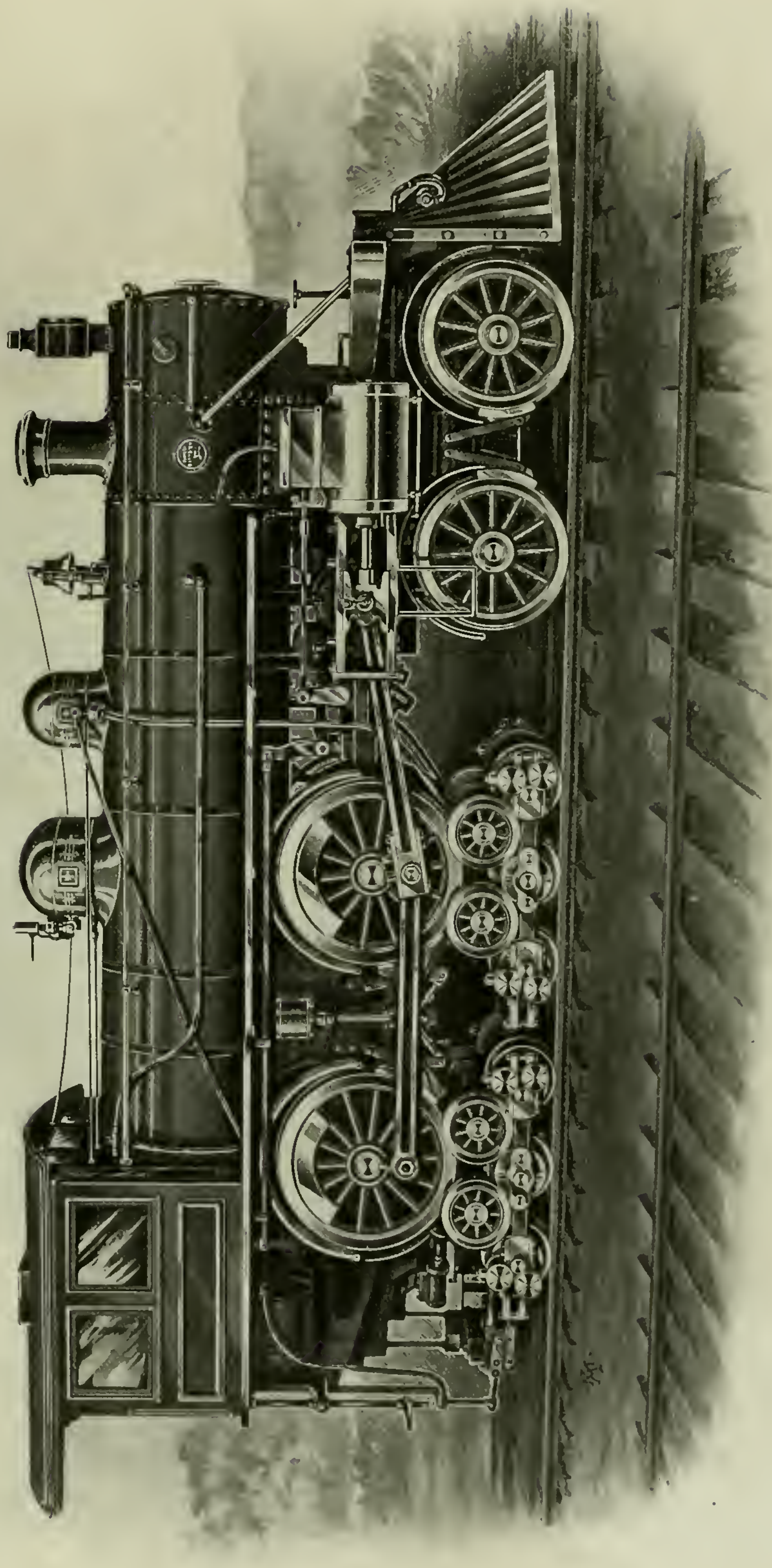
In 1859 we find Mr. Cooke of the D., L. & W. R. R., with his "Ontario." It was a standard wood-burning engine, Roger, ten-wheeler, 17 x 24, wheels 4½ feet in diameter. The firebox was cut off at the bottom and extended back into the cab, which was allowed to remain as it was on the engine while burning wood. The rear axle was under firebox same as on the Mine Hill engine in 1853. This change brought the coal burner to look much like a wood-burning engine, which had much to do in removing the prejudice of engineers against running them. This engine is practically the anthracite coal burner of to-day, and for a long time there did not appear to be any improvement in burning coal on the locomotive. There were changes, to be sure, but they were not all improvements.

In 1877 Mr. Wooten, of the Philadelphia & Reading Railroad, adopted the method, long used in France, of having wide fireboxes and placing them over the driving wheels, for the purpose of burning a poor grade of coal, which has been done, even if it was not economical to do it. By making the firebox very shallow and raising the boiler high above the frame, it was possible to get from 80 to 84 feet of grate surface, which has proved far more than was economical where ordinary fuel was used.

Oil Devices at Hornellsville.

The use of gasoline has barely become well established in shop practice in such work requiring an intense heat, as putting on or removing tires, when a competitor appears in the form of crude petroleum. The apparatus designed by Master Mechanic Weiss at Hornellsville, on the Erie road, is of the simplest character, but very complete. There are two pits built into the mason work, of a width to take in the widest tires, and of a depth that will allow the axles of the smallest drivers to clear the ground when the wheels are let down in place. Two oil pipes with nozzles placed to direct the spray up and around the tread of the tires, and a sheet-iron hood over the latter, constitute the fittings going with the device. Of course there is an air jet used with it, and it makes an intense heat. A gallows frame of channels has been erected over these tire pits, and an air lift traversing the frame makes the removing or applying of tires an easy and quick job. Oil is being largely used in these shops in furnace work, and its application to tire heating was a natural one.

The International Correspondence School, of Scranton, Pa., have sent out a booklet regarding their course of telephony. It is expected that the course will be of much value to engineers, as it gives instruction in both the theory of the telephone and in practical work of installation of complete systems. It will enable any engineer to make estimates for, and superintend the construction of any telephone plant. Those interested should send for this little book.



FADS AND FANCIES OF LOCOMOTIVE BUILDING—No. 12.
THE "HOLMAN," 1897.

Mountain Railroading.

One of our subscribers, Mr. W. J. Hannan, of Boulder, Colorado, has favored us with some very interesting views along the line of the road he runs on, which will particularly interest railroad men in other sections of the country.

The Colorado & Northwestern—aptly called the Switzerland trail of America—runs (29 miles north of Denver) between Boulder and Ward, Colorado, a distance of 26 miles, and is everywhere graced with wild and magnificent scenery. Mr. Hannan has favored us with a view of his engine and train, and for a 3-foot gage engine it shows up very well. The cylinders are 16 by 20 inches, steam pressure is 180 pounds, and the engine alone weighs 47 tons. It can haul five loaded 40,000-pounds cars up a 4.8 per cent. grade (253½ feet per mile), and they have a good many 40-degree curves as well. There is a climb of 3,000 feet in 17 miles, which is somewhat different from railroading on the plains.

Scenery such as is found here must be seen to be fully appreciated, but an idea can be obtained from the views shown with this.

The rocky nature of the country can be seen from the picture of Goat Rock, in Boulder Canon, showing the railroad around the base of the rock and the irrigation ditch and tunnel high up on the rock above. There are plenty of engineering feats to be found in places like this.

One of the sharp curves—we might almost say "kinks" and not be very much out of the way—is seen in the next view, and a general view of the surrounding hills obtained at the same time.

The other view of the road and surrounding country is also interesting, as it gives a varied bit of landscape, with the stream in the ravine, the mountains in the distance, and the road winding up the mountain on the left.

Those unaccustomed to mountain railroading find much to wonder at in the planning and the building of such roads as this, which go up and still further up by varied windings and turnings, taking advantage of every natural formation, and where Nature has refused to assist, by carrying the work on in spite of her. Such railroads command the admiration of the engineers in every part of the world.

A Difference In Men.

One of our friends, who is devoting considerable time to the history of early locomotives, told us of a peculiar experience the other day. He had obtained, through the courtesy of an old engineer, a drawing of the old "Orange," of the Morris & Essex Railroad, now a division of the Delaware, Lackawanna & Western road. This engineer had spent many hours on the drawing, and yet it was freely given from a love of railway matters and an interest in its history.

This engineer referred our friend to a man who was formerly master mechanic of this road, for data concerning some of the details and the exact date of its going into service on the road. This man is now a lawyer, and we are not sure whether this has affected his nature or whether he was always so, but imagine the surprise on being informed that the desired information would be given for a consultation fee of $25.

The contrast between the engineer and the lawyer is worth noting.

How Jake Pulled a Big Train.

Jake Schmitberger was one of the best runners on the road, and he hadn't tried to pull the biggest train when the rest of the boys were trying to make records. His engine was a fair steamer, but didn't hold an enviable record with the boys.

All the rest were pulling sixty-five to seventy cars at times (sixty was the regular train), but Jake didn't seem to notice it. One day, however, he startled all hands by pulling seventy-five cars up the hill, more than any of them, and everybody wanted to know how he did it. But Jake looked wise and said nothing. He told some of his friends, however, "dot der 'Shames Prown' had pulled shust as hard many a time before mit only sixty or sixty-two cars. I vaits till I got er train vot bulled eazy pefore I try der hill mit von big load."

Probably he worked the "Brown" a little harder than usual, but there's a big difference in the way different trains pull.

Two prominent roads, namely, the Chicago and Northwestern and the Erie, have issued orders to trainmen to extend every courtesy possible to returning soldiers or sailors who may lack funds wherewith to reach their homes. This includes everything looking to the comfort of the men, including food and transportation for those unable to pay. We hardly think that any who have, by the fortunes of war, been obliged to accept the generous assistance of these corporations, will ever refer to them as "soulless." It is a handsome thing for the roads to do, and should be heralded the world over.

GREAT ROCK, BOULDER CANON.

The Meadville Vise Company, Meadville, Pa., are sending out a catalog of Barretts horizontal cylinder boring machines. These seem to be well adapted for this work, and are spoken very highly of by those using them.

Burning Soft Coal Without Smoke.

BY ANGUS SINCLAIR.

When you tell the ordinary engineman that it is possible to burn bituminous coal in the firebox of a locomotive without causing the emission of black smoke from the smoke-stack, he looks upon you as a crank or a theorist, and promptly replies that it cannot be done. The reason why the engineman in America believes that black smoke is a necessary result of the burning of soft coal is because he has never had a practical demonstration of the burning of soft coal without causing a smoke nuisance. The enginemen on many railroads have seen in books and pamphlets descriptions of how bituminous coal could be burned in locomotive fireboxes without causing smoke, but they regarded the information as impracticable theories worked out by men who know nothing about the real work of firing locomotives.

About a year ago Mr. Robert Williams, general superintendent of the Burlington, Cedar Rapids & Northern Railway, became impressed with the necessity for reducing the smoke nuisance which made traveling in passenger trains a disagreeable ordeal. He determined to attempt some kind of remedy. One of his acquaintances was Mr. Richard Newsam, of Peoria, Ill., a coal mine owner, who had become an enthusiast about the proper means of firing furnaces of all kinds, locomtive fireboxes among them. Mr. Newsam insisted that the smoke nuisance could be entirely abated if what is known as the single-shovelful method of firing should be adopted. He was such an enthusiast on the subject that he was prepared to take the scoop and show the fireman how it could be done. He got permission to ride on the B., C. R. & N. engines and soon convinced several of the enginemen that smokeless firing was practicable.

Mr. Williams made up his mind that the system should be tried and as a preliminary he called into his office a dozen of the best engineers and firemen and explained what he wanted them to try. The *esprit de corps* of the road is unparalleled, so far as our experience goes, and the men willingly agreed to try it, although most of them asserted that it could not be done. However, they all started out faithfully to give the new system a fair trial, and to the astonishment of those most concerned, it proved a decided success from the beginning.

We are not dealing with theories; we intend to describe the practices of locomotive firing as we have found them, and the conditions on the Burlington, Cedar Rapids & Northern Railway ought to serve as an object lesson to the whole continent.

The writer, who worked for several years as a locomotive fireman, and longer years as a locomotive engineer, and was employed on the Burlington, Cedar Rapids & Northern for seven years, was invited by Mr. Williams to come out to Cedar Rapids and witness the effect of the improved methods of firing. On the morning of my arrival we went out over a division on a heavy, fast freight train. The speed was limited merely by the capacity of the locomotive, which was a heavy ten-wheeler, and the running conditions were to get to the end of the division as quickly as possible. At first I sat in the cupola of the way-car, which gave an excellent vantage point from which to watch not only the engine pulling the train, but all others that we passed or met. Then I rode on the engine and watched how the firing was done. It was an old story to the writer, for he had been accustomed to the same system of firing in Scotland thirty years ago. But ancient practices with tiny engines had been in this case extended to our modern monsters, and the results were the same, smokeless firing.

The road is undulating, with fairly heavy up and down grades—the worst conditions for smokeless firing—but the physical drawbacks did not seem to defeat the men who were working to operate the locomotives without the emission of smoke.

We went to the end of a division the first day on a freight train, as noted, and returned on a heavy, fast passenger train after darkness had descended over the woods and prairies of Iowa. The writer rode on this engine, which had six cars and was making up time. The process known as "hammering her" was followed, and she went up grade about as fast as the power capacity of the cylinders was worth. My business was to watch for sparks, and the verdict rendered was that this system provided the best spark-arresting appliances I had ever seen. It left the sparks in the firebox, the place they belong to.

Next day we went on another division.

SCENE ON THE COLORADO & NORTHWESTERN RAILWAY.

going on a passenger train and returning on a fast stock train. In our two days' outings we saw all sorts of locomotives doing work. There were work engines pulling earth out of cuttings where grade reductions were going on; there were switching engines pulling long and short lines of cars in yards; there were freight engines with heavy and light trains, and there were passenger engines with trains fast and slow, local and express. In all the two days' outing the writer was either in the cupola of a way-car or in some other place where the best possible view was to be obtained of the various engines; and there was no more smoke to be seen anywhere than there would have been had the engines been burning anthracite coal or coke. The evidences of perfect firing were so complete that the results were simply wonderful. The officials and enginemen say that they are going to do a little better when they get more experience with the new system, but I could not see where it could be improved.

The practical results of the improved system of firing are that passenger trains can be run comfortably with the windows open. The company is going to save this year nearly one-sixth of the money paid for fuel last year, and they have done a heavier business than they ever did before. The engines steam much more freely than they did under the system of heavy intermittent firing; the nuisance of leaky tubes has almost ceased; there is no filling up of smoke-boxes with cinders, and there has been a decided reduction in the work of the boilermaker. Last, but not least, the fireman has less work of coal-throwing to do, and he and the engineer are acting together to produce satisfactory results.

The officials of the road are doing all in their power to make it as pleasant as possible for the men working out this method of firing, and every encouragement is given to persevere in the good work. They are putting bell-ringers upon all the engines to relieve the firemen from that duty, and they are putting a low seat in the cab so that the fireman may rest between shovelfuls.

While riding on the engines, I found that the coal was all broken to small lumps and that the firemen kept up the necessary supply of fuel in the firebox by putting in a single shovelful at a time. When the engine with a long freight train was pulling hard on a long grade, the coal thrown into the firebox averaged five shovelfuls per mile, each containing about 18 pounds of coal, which was 90 pounds to the mile. On the level it was about five shovelfuls for every two miles. The fire always looked clear and bright and all the engines steamed admirably. The engineer always filled up the boiler well going into a station, and then shut off the injector for a few minutes in starting, to let the fireman make up a good fire. As soon as the train was going the engineer hooked up the engine as far as he could to avoid tearing the fresh fire to pieces. When the engine was running for a grade a fairly heavy fire was gradually put upon the grates, and it was maintained during the heavy pull; but was made up by single shovelfuls, or, at most, two shovelfuls at one time.

There were no special smoke-preventing appliances used to aid in producing the wonderful results described. The engines all had a brick arch, but no means were employed to admit air above the fire. A few days later I rode on passenger engines on the Toledo, Peoria & Western that had no brick arches, and they made no more smoke than those on the Burlington, Cedar Rapids & Northern. They were also fired on the one-shovelful system, Mr. Newsam having shown the firemen how to do it.

In getting the improved system made a success, Mr. Williams was greatly helped by the hearty co-operation of Mr. R. W. Bushnell, master mechanic, by the energetic labors of Mr. J. H. Burns, assistant master mechanic, and by nearly all the officials and enginemen on the road. Mr. Williams asked several of them to write a letter telling what they thought about the new system of firing, and I shall let them tell the rest of the story:

Mr. Williams wrote: "From January 1, 1898, to October 1, 1898, we have used 104,361 tons of coal, as compared with 114,887 tons for the same period of a year ago, making a decrease for the nine months of 1898 of 10,526 tons. Our train mileage for the same period of 1898 was 2,291,033; for 1897, 2,201,381; an increase of 89,652 miles in 1898. While we have no figures bearing upon the tonnage of trains, yet it is safe to say that our trains this year are heavier than those of 1897.

"I think that this saving, which appears to me to be remarkable, has been brought about by demanding long runs to the tank

ONE OF THE CURVES, COLORADO & NORTHWESTERN RAILWAY.

of coal, a thorough inspection of our coal, more attention to the weighing, the new system of coal reports, by which we check our coal into and out of coaling stations, and the new style of firing. It is impossible to determine what proportion of the saving has been brought about by the new system of firing, but I judge that 75 per cent. can be credited to it.

"Our coal is obtained from Iowa and Illinois in about equal proportions. The Iowa coal contains sulphur, stone, unformed coal and bone. These impurities we aim to eliminate by careful inspection. The Illinois coal is the lowest priced coal in the Peoria district. It is comparatively free from impurities, and slightly excels the Iowa coal when the impurities as above are removed. The same style of firing obtains with both coals, and our enginemen recognize no difference when using them.

"You have asked for certain letters which our officers and employés have written at my request upon the subject of the new style of firing, and I will request you to make such use of these letters as you deem best.

"I believe, while we have accomplished a great deal, that we have not obtained perfection, and that our continued efforts along the lines now in effect will terminate in better results than those you have witnessed while you have been with us."

Mr. J. H. Burns, traveling engineer, wrote: "Formerly I have had report after report of engines not steaming; these were acted upon when received; front ends were examined and the appliances therein tested, to ascertain whether they were defective. Many times changes were made and old appliances removed from the front ends and new types put in, with the purpose of improving the steaming qualities of the engine. Now it is a rare thing to find a report on the work book, or from the transportation department, of engines not steaming or failure on the road due to that cause. Our men are becoming more interested, as they see the great results achieved from their past efforts. I feel, and so do the better class of engineers and firemen, that the present system is the proper one."

Mr. J. C. Tindall, engineer, wrote: "I find from my experience that an engine can be fired with one and two shovels of coal and kept hot and avoid the unnecessary black smoke and popping off of engines, if the required interest is taken by the engineer and fireman.

"I make a great deal better mileage under the new method, with the same engine, that I did under the old method, and recommend the new method to be a great deal better than the old way of firing.

"My run is train No. 6, with from nine to twelve cars, from Cedar Rapids to West Liberty, a distance of thirty-seven miles; schedule time one hour (I usually make it in fifty minutes); and from West Liberty to Burlington, sixty-one miles, five cars, schedule one hour and fifty-five minutes, with stops every five miles. I return to Cedar Rapids on train No. 5; distance ninety-eight miles; five cars; schedule three hours and twenty minutes; eleven stops.

"My engine is an eight-wheel 18 x 24-inch, carrying 160 pounds steam pressure. The run from Cedar Rapids to West Liberty on train No. 6 is our heaviest train, and this with the balance of my run is fired with from one to two shovels of coal at a time, never to exceed two shovels. I consume from 4½ to 5½ tons of coal in making the above two runs of 196 miles."

Mr. Fred. McArdle, an engineer, wrote: "Speaking from an engineer's standpoint, I consider this method of firing a decided success in every respect, for the reason that it has brought about a great saving in coal; also, it has demonstrated to us that it is much less labor for the fireman and more pleasant for the engineer. The engine is not popping off continuously while standing at stations. The cab and train are not smothered in dense black smoke from the time engine is shut off until the train is again started.

"Prior to the time that our method of light firing was adopted, we were firing our passenger engines with three to five shovels of coal to a fire; at the present time we are firing the same engines with one shovel of coal to a fire, and at no time do we exceed two shovels to a fire, and they are used only when starting trains away from stations and going over heavy grades. Under the old method of firing, all passenger engines were obliged to take coal at intermediate coaling stations; but at the present time the same engines are running from 155 to 250 miles without taking coal Taking all things

ONE OF THE TRAINS ON THE COLORADO & NORTHWESTERN.

into consideration, we save from 2 to 3½ tons of coal on round trips. The size of trains above mentioned is from three to six coaches; engines from 15 x 24-inch to 17 x 24-inch.

"Through freight engines on all divisions are 18 x 24-inch, six-wheel connected, and they are fired with one and two shovels to a fire; and it is a very rare thing to see them throwing out black smoke while running between stations, unless it be when train is toiling very slowly over heavy grade. These engines are running from 96 to 105 miles with one tank of coal. With freight trains we are saving from 2 to 4 tons of coal on a round trip. Our trains will average about thirty loads each way over the divisions.

"To make a success of light firing, it is necessary for engineers and firemen to work together. The fireman should carry a clean, light fire, keeping the fire thin enough for plenty of air to be admitted for combustion. This he cannot do if his engineer, in starting, allows his lever to remain at full stroke for a quarter of a mile or more before he begins to cut it back. Under such conditions, the fireman with a light fire would have very little fire left in his box by the time the train had moved half its length. Where the engine is fired lightly and the fire is light and level in the box, the engineer must be very careful when pulling out of stations; he should also be careful when dropping his engine on heavy grades. He should commence in time, and drop his lever gradually. This enables the fireman to carry a light fire at all times, and we must admit that there is nothing so beneficial or so economical on fuel as a clean, low, level fire. Not only should the fire be attended to carefully, but the water should be attended to, just as closely as the fire. The boiler should have a good supply of water before starting out, allowing the fireman time enough to build his fire and get it in good condition before the injector is put at work. If the water is low in the boiler when starting out, the injector must be put to work at once; the fireman has not had time to get his fire burning well, and the result is that the fire is forced for the first few miles, and probably spoiled for the balance of the trip.

"In speaking of firing the old way, I would say that when we were taught to fire an engine, we were taught to put a shovelful of coal in each corner of the box and one or two down in the center; and I will venture to say that nine firemen out of every ten were taught to fire in the same manner. That system of firing was a mistake, although it has been practiced here for many years; but it has been demonstrated to us within the past few months that the same engines can be fired successfully with one and two shovels of coal at a time. I have not been on the fireman's list for the past ten or twelve years, but am willing to admit that there have been thousands of tons of coal wasted by enginemen firing too heavily and the careless management of engines in their charge."

Mr. Simon Cameron, an engineer, wrote: "Under the old way, on my run of 207 miles the engine would always lag for steam on the last 60 or 70 miles, from the fire being clinkered and the firebox being so full from heavy firing; but under the new system the engine does just as well the last mile as she does the first, and if we were compelled to return right away, I would not be afraid to start back without cleaning the fire, and have engine to steam all right all the way back. I never fail to look in the firebox at the end of the run, and I must say, with but one or two exceptions, there were no clinkers, and the fire would not be more than 6 inches deep. On our return trip, the run is from Estherville to West Liberty and return to Cedar Rapids, with three hours of dead time at West Liberty, making mileage of 290; and the engine steams just as good the last mile as the first 50 miles. Sometimes if the fire dies very low at West Liberty, the fireman cleans off the dump grate, and when we arrive at Cedar Rapids the fire is all right to go through to Estherville, if the engine was needed to go through. In regard to black smoke, we have some, but you might say that it is almost a thing of the past.

"When I was assigned to this run, one year ago, the regular train was three cars, and at the present time it is five, and the time has been shortened until it is one of the hardest runs on the road, except one. This I know by having the experience on them all. At times the coal has not been the best; but I have never seen the time but what the engines were hot, and we have had three different engines on the run. And another thing I have noticed by observing the work book—you don't see one engine reported 'Not steaming' under the new way, to ten under the old way of firing."

Wm. McMullen, engineer, writes: "We will take a three-car passenger run of 125 miles. In the old way of firing, it was impossible to pass intermediate coaling stations without taking coal, and on the round trip it would take from 7 to 9 tons of coal. The fireman would fire the engine with from three to five shovels of coal at a fire, making one continual stream of black smoke. In the new way, on the same run, we do not take coal on the round trip of 250 miles, and use from 4 to 6 tons. The fireman fires the engine with one shovel of coal, and it is a very rare thing to see any black smoke. Being in all kinds of service and handling all kinds of trains, I will say something in regard to the day trains on the main line. Engine, 18 x 24-inch, pulling five and six cars on a run of 155 miles, with a schedule of about 30 miles per hour, and with twenty-six stops. In the old way of firing, we would take from 10 to 12 tons on this round trip. The fireman shoveled not less than four scoops at a time. Under the new system we make round trip without taking coal only at Albert Lea and Cedar Rapids, thus saving time by running intermediate coaling stations. We now take from 8 to 10 tons of coal in making 310 miles.

"In regard to the freight trains: On our through runs, using an 18 x 24-inch ten-wheel engine, with the old way of firing we would take coal at all intermediate coaling stations. The fireman would use from four to eight shovels of coal at a fire; but under the new method of firing we take coal only every 100 miles, and the firemen are firing the same engine, with similar trains, with one and two shovels of coal, and are saving on an average of from 2 to 3 tons of coal per round trip of 310 miles."

Mr. Henry Raps, foreman boilermaker, whose articles on "Boiler Construction" are familiar to our readers, wrote: "The most noticeable improvements brought about by the new method of firing are: The freer steaming of engines; the longer life and more uniform wear of brick arches; the decrease in the number of burned and broken grates; the decrease in the number of bent and broken ash-pan dampers and their fastenings; the fewer number of stopped-up flues; the longer life of nettings and stacks; the total absence of burned smoke arches and extensions, and the non-accumulation of cinders in front end.

"A comparison has been made between the first eight months of 1897 and the first eight months of 1898; the two periods will be referred to as '97 and '98.

"During '97 and previous to that time, the words 'Eng. don't steam' were placed upon the work book from two to four times a day, usually resulting in changing the nozzle, stack or deflector; during '98 the report has been made from one to two times a month.

"On account of the fires being lighter now than formerly, less ash and cinder accumulate on the grate, resulting in the openings in the grates being free from cinders.

"As a smaller amount of coal is thrown into fireboxes now than formerly, and as a smaller proportion of it finds its way out of the stack in the form of cinders, it follows that fewer cinders strike the brick arch.

"On account of fires not being so thick as formerly, there is not as much liability to throw coal against the arch. As there is less fire to clean out at the end of a trip, there is less danger of the arch being struck by the clinker bar. For these reasons brick arches last longer now than formerly.

"During '97 fifty-one brick arches were applied to locomtives; the average mileage per arch was 7,863. During '98 144 arches were applied, forty-five of which have been replaced; the remaining ninety-nine are still intact.

"The forty-five arches have made an average of 9,703 miles each. The average cost, including maintenance, of one arch for '97 was $6.41; an average cost of 8 15-100 cents per 100 miles. The average cost, including maintenance, of one arch for '98 was $4.61; an average of 4 75-100 cents per 100 miles; effecting a saving of $81 on the forty-five arches replaced in '98, and $259 on the total number of arches put in.

"On account of the heavy fires formerly carried, and the consequent heavy clinkers, grates were frequently broken when fires were cleaned. The total expense of replacing broken and burned grates in '97 was $91.56; for '98 the expense was $44.30, a saving of $47.26 for '98.

"Before the new method of firing was adopted, large clinkers were invariably formed on the grates, becoming so hard in cooling that it was almost impossible to break them with the clinker bar; as a rule they were forced through the end of pan, eventually breaking the front damper and its fastenings. The expense of repairs on this account in '97 amounted to $23.40; for '98 the expense amounted to $8.20, a saving of $15.20.

"The difference in the number of flues stopped up is almost incredible; formerly there were fifteen to thirty, now there are five to ten—oftener the former number.

"The expense of replacing nettings during '97 was $61.32; for '98 the expense was $33.11, a saving of $28.21. The number of stacks renewed in '97 was twenty-six, at a cost $5.23 each; in '98 the number was fifteen—a reduction in this item of expense of $57.53.

"Compared with '98, considerable expense was made in '97 by front ends heating, causing the sheets to bulge and crack. During '98 there has been no trouble of this kind whatever. As no record has been kept of this item of expense, the exact amount saved cannot be given. Fifty dollars is a fair estimate.

"Probably the greatest proportion of expense incurred by the accumulation of cinders in front end was that caused by delays on the road. The report, 'Front end fills up,' is now a very scarce thing on the work book. It usually resulted in front end being opened and adjusting deflector.

"These are the more important improvements brought about by the new method of firing. Those of minor importance are the non-accumulation of cinders in netting, causing delays while cleaning on the road, and occasionally resulting in the loss of hand-hole lid.

"There is now scarcely any occasion for opening cinder-hopper, which formerly resulted in a leaky joint, and eventually in a burned front end and a cracked hopper.

"The front damper rods also made their share of trouble. On account of the dampers being bent, they were hard to operate; sometimes resulting in a broken damper rod.

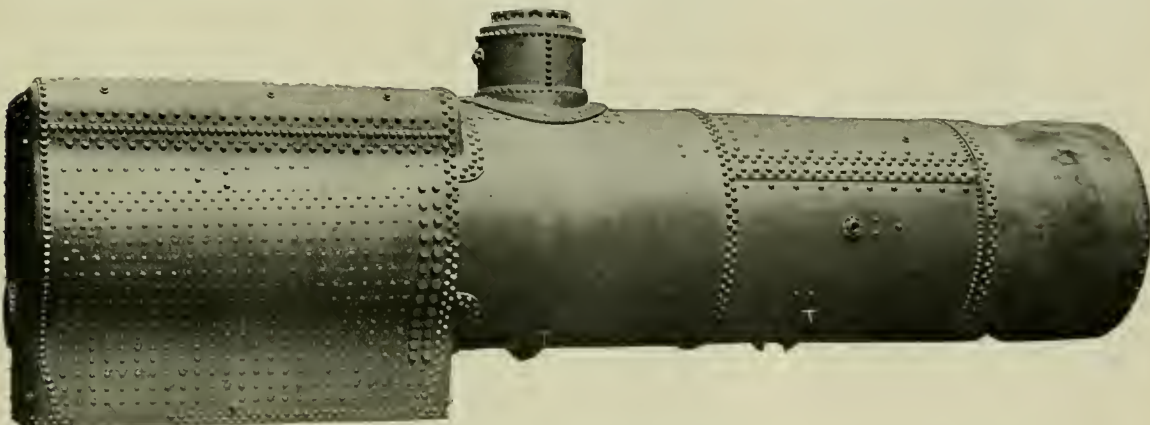
"These are the direct results of the new method of firing, as no change has been made in any part of the engines from their former equipment, except that all engines are now equipped with a brick arch."

Mr. O. H. McCarty, train master, wrote:

"One of the principal features of the new system of firing is, that we are now running our passenger trains over our lines with doors, windows and ventilators open, and are not troubled with black smoke, which has been declared to be injurious and a nuisance to the public, and also ruinous to the appearance of depots and other buildings; it also represents a waste of fuel.

"The same improvement has been made with engines on our freight trains. Having no black smoke makes it much pleasanter for all concerned, but more especially for the brakemen to get out on top and perform their duties, and also lessens the danger. It is a well-known fact that in the old system you would notice large volumes of black smoke pouring out of the smoke-stacks of our engines when running into or standing at a station. I am pleased to say this has apparently all been done away with. We all understand that even the saving of one to two scoops of coal per train mile will aggregate a large sum at the end of the year.

"I am satisfied this saving is being made now by increased care and skill in firing, and it has, no doubt, resulted in a large saving. Owing to the fact that it is such a comparatively short time since we adopted the new system of firing, and that we have received such good results, I think the engineers and firemen, who have co-operated with us in carrying out our instructions and in making the new system of firing a success, are deserving of a great deal of praise."



BOILER OF BURLINGTON & MISSOURI ENGINE, BUILT BY PITTSBURGH LOCOMOTIVE WORKS.

New York Railroad Club.

The annual meeting of the New York Railroad Club for the election of officers was held on the evening of November 17th, with a packed attendance. The official roster for 1899 is as follows: President, H. H. Vreeland; first vice-president, C. M. Mendenhall; second vice-president, S. Higgins; third vice-president, D. B. McCoy; treasurer, C. A. Smith; Executive Committee, W. W. Snow, G. W. West, A. E. Mitchell; Finance Committee, R. M. Dixon, D. M. Brady, C. S. Henry.

A treat was enjoyed by those in attendance, in listening to a lecture by M. N. Forney, entitled, "A Talk to Railway Men and Supply Men on Character and Conduct." This talk was replete with the bright and good things for which everything flowing off the end of the pen of that distinguished author is noted. It is noteworthy that C. A. Smith, the veteran master car builder, and W. W. Snow, of wheel fame, are the only surviving original members of the New York Railroad Club. The confidence of the club in these two members is shown by their repeated return to the treasurer's office and the Executive Committee, respectively. If that old saw, "A woman is as old as she looks, and a man is as old as he feels," has anything in it, these club stand-bys will be on deck to counsel the next generation of club members.

Practical Letters from Practical Men.

All letters in this Department must have name of author attached.

Piston Valves.

Editors:

Although piston valves may be balanced—probably are—the friction is there all the same, and the engines handle hard in many cases. The reason is not hard to find, as the steam gets under the rings and forces them against the valve chamber. Aside from this difficulty, which is not without a remedy, there is little against the piston valve except its weight.

There is another feature, however, that is claiming attention, and that is the higher mean effective pressure in the cylinder due to straighter ports from valve to cylinder. Allowing this to be the case, and the same effect can be obtained by using a long slide valve, balanced at each end, or using two separate valves on the same valve rod, as has been done many times, and as some stationary builders do today. James Milholland tried it on his famous "Illinois" in 1852, but did not find the difference worth the extra expense, and several others have had a similar experience.

There is no denying the advantage of direct ports; the only question is, How much can we afford to pay for them in the way of weight, friction and expense of valve? I haven't changed my mind regarding a practically solid valve since the letter on page 379 of the August issue.

R. E. Marks.

Camden, N. J.

Keying up Main Rod.

Editors:

There has been a little discussion on this point in your columns, and I must agree with Orange Pound in nearly everything.

In giving a rule it is best to give one that is always right, if possible, instead of one that may be right in some cases, but is not likely to be in any. I go so far as to say a rod should never be keyed up on the center, and will give my reasons.

Even with a pin perfectly round, it is not right, because unless the valve has no lead, there will be a pressure one way or the other on the pin, and the engineer is pretty sure to either key too much or too little, according to whether the pressure is with or against the key. Too much means a hot bearing; too little, a pound. This is, of course, on the supposition that the rod is keyed up with the engine hot, so as to allow for all expansion that occurs in running.

With the pin on the quarter and ports covered the conditions are always the same, even for a new pin, and for a worn pin there is no question as to this being the proper position. Any engineer or roundhouse machinist will testify to this. It seems as though the theorizing had been on the wrong side.

I. B. Rich.

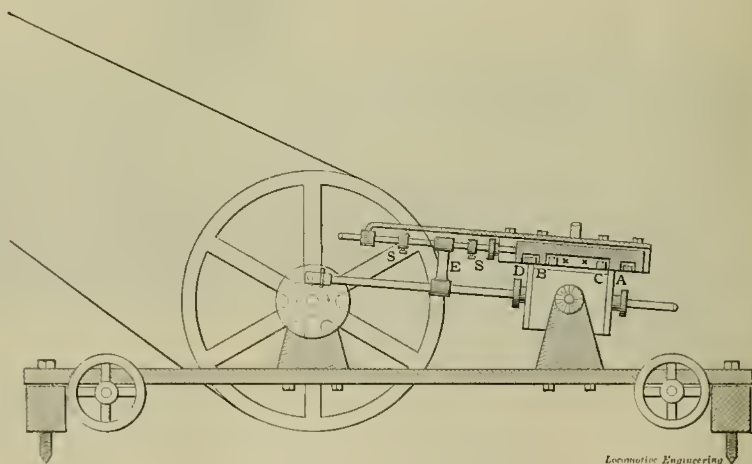
Honeybrook, Pa.

Oscillating Air Engine.

Editors:

I send you sketch of a small engine, driven by compressed air, which is designed for driving boring bar, for boring out locomotive cylinders, or a small lathe or planer, in case of necessity.

The bed plate rests on four wheels, so it can be easily moved wherever wanted. Two blocks are put under the bed plate



OSCILLATING AIR ENGINE.

and fastened to the floor. After being put in line with pulley on boring bar, the air hose is connected and the engine is ready for operation in either direction.

The full air pressure follows the piston to or nearer its dead point, and can be run to most any speed. The valve is very simple in construction—is a square piece of cast iron (length according to length of cylinder); the ports for taking or releasing air are all drilled with a ¼-inch drill, also ports *B* and *C* in cylinder, and *A* and *D* outside of cylinder, for release.

The valve is surrounded by air; a couple of holes are drilled through top of valve, to let air in to the inner part of valve *X X*.

It will be seen that the air chest is cast on cylinder and projects over both ends of cylinder, and the air-chest cover is fastened on with top bolts.

The valve-reversing arm *E* causes the movement of the valve, and is regulated by set screw collars *S S*, to the required stroke of valve, which will be somewhat cushioned, and also the piston, when same comes near its end of travel.

The piston rod extends through back end of cylinder, and on its front end is directly connected to the crank pin, which of course gives the oscillating movement.

J. A. Eisenaker.

Elmira, N. Y.

Old Housatonic Railroad.

Editors:

I notice an article in September Locomotive Engineering, page 415, about old men who were in the employ of the Housatonic Railroad, many years ago. I note that the old engine "Housatonic" is mentioned, and wish to say that while I was a schoolboy, at Stockbridge Iron Works, this engine came North on the mail train one day and ran off the track into the rocks in Glendale cut and was badly wrecked. The engineer's name was Howard. He was not hurt, nor was anybody else.

I was there and saw the engine put back on the track again. This must have been in the spring of 1852 or 1853. This engine was sold to Mr. R. C. Root, President of the Bennington & Glastonbury Railroad, and placed on that road sometime in 1873. The engine was used there about two years and was the first engine that I know anything about that had a steam driver brake. This was applied at Bennington, Vt., as per my direction. This engine was afterwards sold to Mansfield & Stimson, machinists, at Rutland, Vt. They took off one cylinder and repaired the boiler, which was a dome, or round top and back boiler (Bury, probably), and sold it to a lumber dealer up in the Green

Mountains, where it is in service at present in a sawmill.

In speaking of the Housatonic Railroad men, I was quite well acquainted with Mr. Charles Hunt, who was at one time president of this road. I also knew Engineer Sterling, of the engine "Antelope," and Pat Late, who ran the "Reindeer," and Chauncy Morris, who ran the "Falls Village."

I also remember well the vestibule passenger trains this road used on their line in 1852, or thereabouts. Perhaps the Clarks and Hawleys may remember some of them. However, I have no idea that any of these men will remember me, unless Mr. Morris or his brother, Sidney Morris, might possibly think out the boy that hung around them so much for a year or so, about forty-five or forty-six years ago.

C. J. McMaster.

Rutland, Vt.

A Cheap Throttle Stem Packing.

Editors:

One of the little economies practiced in the Fall Brook shops is the use of worn-out air-brake hose for packing the throttle stems of the locomotives. These old hose are generally regarded as practically worthless; but for this use they answer every purpose and prove very durable. They are cut up in rings of the desired size by a die made of tool steel of the form shown in Fig. 1. The hose is split open and nailed to a piece of plank, and the die forced through by hydraulic pressure.

The rings thus formed are applied without cutting by slipping over the end of the stem.

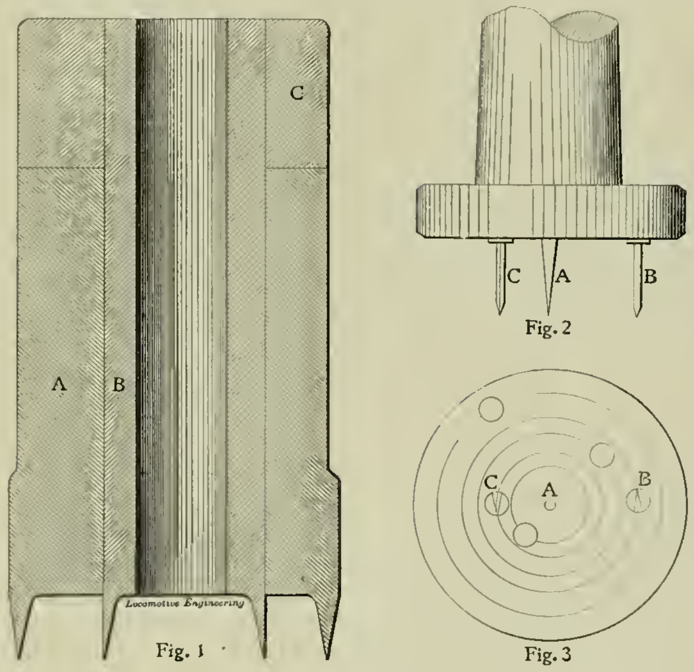
This packing seems to be of no value where there is a constant reciprocation like a valve stem. Probably if there was depth enough to the stuffing-box to get in a sufficient quantity, so that the whole mass would not be subjected to the extreme heat of the steam, it would be more durable.

Rubber gaskets for use on lubricators and water glasses, which appear to be superior to the manufactured article, are made from old rubber car springs. The springs are mounted on a mandrel in a lathe, and with a long knife disks of the required thickness are cut from the end. After a sufficient number of disks have been cut, a center carrying knives, as shown in Figs. 2 and 3, is slipped in place in the spindle, and the lathe run at a high speed. The rubber disks are then taken and pressed against the ends of the revolving knives *B* and *C*, which are pieces of wire filed to shape and pressed in holes drilled in the end of the center. The small center *A* holds the rubber so that concentric circles are readily cut. The different sizes are provided by holes drilled in larger and smaller circles.

As arranged, it is necessary to stop the lathe with a brake to remove each gasket as cut, but a simple ejector could be easily attached.

Fred E. Rogers.

Corning, N. Y.



PACKING CUTTERS.

Apprentices on Piece Work.

Editors:

The age of cost-cutting has kept advancing, until the apprentice is at last being compelled to learn his trade on the piece-work basis. It has even gone one step farther. To keep his earnings down to approximately what they would be on the day-work system, he is also obliged to accept a scale of prices of only half what the journeyman gets.

To begin with, the apprentice, for his sake, ought not to learn a trade at piece-work. From the very nature of affairs, he will continually sacrifice the acquiring of skill for that of money. What makes the all-round mechanic is the undertaking of jobs that are unfamiliar to him, and the thinking out for himself of the easiest and quickest way of doing them. At piece-work this spirit of inquisitiveness is not given a proper chance to develop. When a boy gets to earning a little more than wages at any one kind of work, he is quite contented to stay right at it as long as he is allowed. He doesn't like to be changed to another class of work where the prospects are not as good for earning as much. Neither does he like to tackle new jobs just for the sake of losing money on them.

Thus his tendencies are to become a quick workman at only one thing, but unskilled and inexperienced at all others.

But if he must bow to the inevitable, he should, from every standpoint of honor and fairness, receive the same prices as the journeyman. Thus, where is the justice of the two working side by side, fitting in bolts, for instance, the one receiving 10 cents a bolt and the other being allowed only 5 cents for doing exactly the same work? This idea undoubtedly originated out in the country among farmers, who thought it was right to pay a boy—because he was a boy—only 50 cents for digging and picking up as many potatoes in a day as the full-grown man beside him that received $1. If the apprentice can do a job just as good and as quick as the journeyman, then he is just as good a man, and ought to receive exactly the same pay. Generally they do the work as well, but cannot do it as quickly; and here is the true criterion by which to judge them. If they can't work as fast, then they can't earn as much money for themselves nor their employer, and are inferior workmen by the amount they fall behind.

No; apprentices have been a paying investment for those employing them, as is shown by the fact that the regular prices have been reduced by half to keep them from earning as much as journeymen when put at piece-work. Whenever, then, it seems advisable to do this, let them work for the same prices, and they will realize their inferiority by not being able to turn out as much work, and will strive to overcome it.

Robert Royale.

Patching a Flue Sheet.

Editors:

The sketch attached shows a flue sheet we patched here five years ago. This boiler, when it came to the shop in the summer of 1893, was solid with scale between the flues, and as a consequence the bridges between the flues were badly cracked. Instead of putting in a new sheet, we cut out the worst places and patched them as shown in the three different places. The method taken to do this work was to cut the piece out of material sufficiently large to allow the outside row of holes to be drilled full; then sheared the patch as near as possible through the center of the outside row of holes and removed the defects from the old sheets. The old part was then cut away, and the new fitted into its place a reasonable fit; after which the patch was held to place with clamps, and holes drilled at the joints, tapped, and plugs screwed into place that were just a little larger than the width of the bridge. The plugs were then riveted inside and outside, and the parts extending into the flue holes were filed away to conform to the circle of the flue hole.

This boiler left the shops to go into service in a roundhouse July, 1893, and has arrived at the shop again for repair. Upon removal of the flues the plugs did not show the least sign of having been disturbed, and the intention is to remove the flues and send it out again with the old sheet for further service.

CHAS. E. FOURNESS,
Foreman Boilermaker.

Dubuque, Iowa.

Perfected Artificial Limbs.

Editors:

The writer of this letter was at one time a locomotive engineer, having been engaged in that business for sixteen years, and while pulling the fast train of the Wisconsin Central Railroad, St. Paul division, during the World's Fair, I had the misfortune to lose my right foot, the engine going through a bridge. This necessitated my purchasing an artificial leg as a substitute. The first year, I purchased four different makes of as many different firms, but could not get one that would give me comfort. My mechanical knowledge came to my relief, and I invented the artificial limb that is now considered one of the greatest inventions that was ever brought forward for the comfort of man.

We established our business of manufacturing artificial limbs about four years ago, and have improved and perfected the same, until we have to-day a limb that is sold and shipped to all parts of the country. We mail you, under separate cover, a circular which explains the leg, also shows the interior construction of the same. It also contains recommendations from prominent railroad men, who have worn different makes of limbs before being supplied with ours. We mail you this so you will be able to see just what we are doing. It may seem queer to you that a railroad man should be engaged in a business of this kind. However, we undertook to establish ourselves, and the results of our efforts are abundant proof of our success. There are, as you know, a great many of our railroad men losing their limbs, and we would like very much to have attention called to this invention of ours in the LOCOMOTIVE ENGINEERING, giving a description of this invention, as we are positive it will be appreciated by all railroad men wearing artificial limbs.

J. J. LEIGHTON.

St. Paul, Minn.

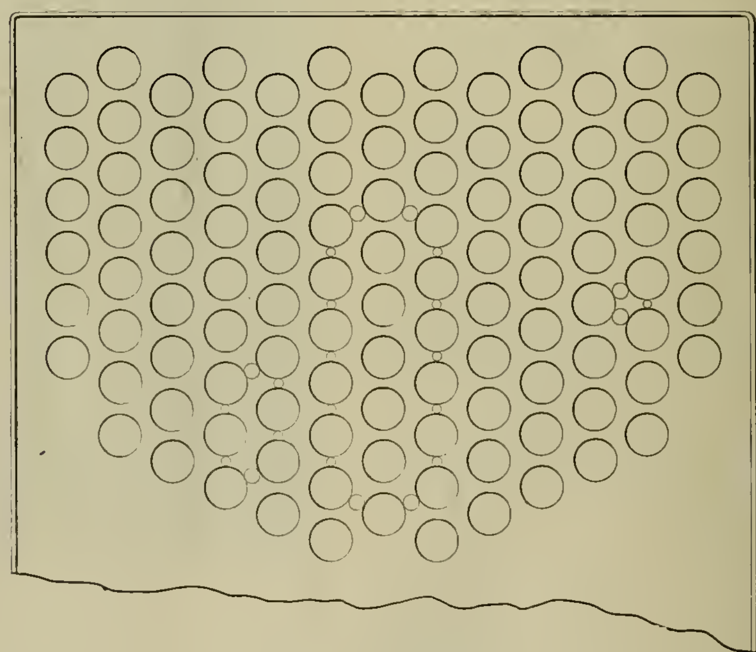
Lodge Room Mysteries.

Editors:

When the M. V. and V. & N. were both narrow gage, there was a fireman on the first named road named "Tom" Boland, a fine boy, but at that time not long from the "ould sod." After a year with the scoop Tom expressed a desire to join the B. of L. F. He was much in fear, however, of the "goat," but the boys told him to fear nothing, just hire a horse and learn to ride, and he could manage the "goat" easily enough. Besides, they promised to feed the "goat" neither tin cans nor oats until Tom was a full-fledged "tallow-pot."

About this time a lot of South Park men with their engines were sent to the M. V., and a bigger lot of "divils" (I am told) would have been hard to find. They nearly all belonged to the B. of L. F. These men decided that the "goat" should be in elegant shape when Tom presented himself for initiation. Mr. Goat was fed (on the quiet) plenty of tin cans, etc., and by the time Tom had screwed up his courage sufficient to "jine," was in good shape. One day previous to one on which Tom had decided to embrace the mystic signs, etc., of the Brotherhood (and incidentally the "goat"), he met a friend, also a fireman, and confiding his intention to him, asked his friend "to be sure and have enough there to initiate me." Evidently Tom's friend took him at his word, as when Tom, with faint heart and trembling legs, arrived at the lodge room, the house was full.

While the opening ceremony was in progress, our now thoroughly frightened fireman would have fled; but as the "gang" anticipated this, they left two of the boys outside to prevent him from making his escape. Opening ceremony over, Tom, hoodwinked and handcuffed, was led unwillingly to inside door, where, after a lot of mysterious raps and alarming talk, he was allowed to enter the "hall of mysteries." Here again more raps and talk, and Tom was told to mount the "goat," who had meanwhile been led forth. Grasping the reins (for they had a goat all right), Tom attempted to mount. Being blindfolded, of course he was heavily handicapped, and as "goat" made a lunge sideways (being jabbed with a pin), Tom, with one foot in stirrup, was thrown to the floor. He managed, however, to hang on to the reins, and as he got on his hands and knees, the billygoat's blindfold was removed, and his natural instinct being aroused, he struck Tom full force "where the bustle ought to be." Well, I must not



PATCHING FLUE SHEET.

give it all away; but seats upside down, red-hot stoves and streams of water, not to forget plenty of smut, seemed to meet poor Tom and his "goat" at every jump. Tom's superstition being now thoroughly in evidence, the "goat" was stabled, and Tom led before the Grand Master, who had a very deep bass voice, and who ordered Tom's clothing (what little was left) removed, and then in his deepest tones ordered an axe and block. Tom, pale as a ghost and nearly in hysterics, was forced to the floor and his neck placed on the block. As the G. M. said "Strike," Tom, with one wild, mad effort got away from his captors, and tearing off his blindfold, rushed to a window, where, had it not been for a couple of quick fellows who seized him, Tom would have sprung right through a second-story window. The "gang" quieted him down a little until he could speak, and the first thing he said was, "Byes, Oi have seventeen hundred dallars in the bank, and Oi'll give it all to yees if yees'll let me out." Next day Tom met his friend, who asked him if there were enough there to initiate him. Tom's answer was quick—"Shure one would have been too many."

L. D. SHAFFNER.

Hope, Idaho.

Cause of Rough-Riding Engines.

Editors:

In opening this letter I must repeat a story I heard your worthy Editor tell, and the moral shall be applied. This happened about six years ago, when the New England Railroad Club held their meetings in the parlors of the United States Hotel. The subject under discussion was "Steel vs. Hammered Iron Axles," and there was a great beal of "bosh" from men who thought they knew, but did not. It was the old, old story—"We are satisfied with what we have, and what we don't know about it is not worth telling." Well, to come to the story:

President Twombly remarks, "We have Angus Sinclair, of LOCOMOTIVE ENGINEERING, with us, and he should know something about this subject."

"Mr. President, the remarks of some of the members remind me of the fish bowl and the fish theory. It seems for years that everyone accepted as true the statement that a fish being placed in a bowl full of water would not add to the weight of the bowl and water. So one day some fellow (no doubt a crank) weighed the bowl and water at first, and then placed the fish in and weighed bowl, water and fish, and he found the increase in weight was just the weight of the fish. And, lo! another theory was exploded."

So with the spring equalizer on the locomotive. Some fellow years ago conceived the idea of placing a beam between his wheels and coupling his leaf springs to it, and because it seemingly rode a little better than when the ends of the springs were fastened to the frame, all others followed after him, and have been doing so ever since. Although they realized the whole plan was faulty, they had not ingenuity enough to make a radical departure, and have gone right along altering the details and not the principle of a system that is completely fallacious. Why? Well, look at the enormous expense for driving springs, the constant renewals of gibs, hangers, etc., and the shims under the equalizer, made of the hardest steel, being ground to pieces; furthermore, the vibration and rolling set up in the boiler, and by such equalizer and springs, prove this; and last, but by long odds not the least, the international complaint from enginemen and firemen about the terrible hard riding of the engines. Why, bless your heart, I could fill your paper with complaints, and only refer you to page 461 of your October issue, containing a letter from D. H. Stewart, Penrith, New South Wales, Australia: "I don't think there is a matter that is of such importance to engine drivers as the fact of rough riding. It is telling a serious tale on the running men; they are giving away in the back and legs very fast." So you see the complaint is really international, for Mr. S. says he has run both American and English locomotives.

I will close this subject by showing "how and why" the leaf and spirals in series will carry the boiler and frame on an even plane or straight line, while the wheels rise and fall, due to the uneven plane, such as bad joints, frogs, switches, crossings, etc.

In designing my spirals, I calculate the weight of the boiler and frame without coal or water, and make them equal to this weight. The half-leaf springs are designed to draw about flat with the boiler full of water and firebox with a proper amount of coal; the spirals are hooked onto the ends of each left spring, with the "T" or hanger fitted with a nut to provide means for giving an initial tension to the springs.

As each pair of wheels carries a different load, I provide tension on the spirals to equal this difference. If the same size spirals at each pair of wheels will not poise the load when the nut on the end of hanger has been screwed up an inch, we substitute a heavier spiral. The plan is, to find the proper initial tension the load requires on the different sets of spirals. When this is done we have our engine now poised on what can be better termed the sensitive or just-balance point. When the water and coal are loaded on, the leaf spring just feels this load, and if the plane or track the wheels roll on was true and not uneven, there would not be a quiver of either spring or engine; but the joints, frogs, etc., keep the wheels rising and falling, and as the spirals are only capable of carrying the load, the wheels rise and carry the box up. They lift the leaf springs at the same time, and the hangers pull on the free ends of the spirals, and they must compress, for they cannot lift the load. So also when the wheels drop into a bad joint, the spirals being under an initial tension or compression of, say, 1½ or 2 inches, will, when relieved of the load, expand exactly the distance the wheel has dropped, and as the expansive action of the spring is extremely quick, the load has not had time to drop, for the wheel is in and out of the inequality pretty fast when moving, say, forty miles per hour.

I have given eighteen years to this phenomenon of springs, and I can say boldly that the whole principle of the spring-makers' art is wrong as at present applied to the suspension of locomotives, and I challenge any or all of them to disprove what I say. Even your note on my last letter shows how little you know of the present practice of building up a spring far and away out of all proportion to the duty required of it.

Why do springs break? Why do locomotives ride hard? Why do gibs and hangers cut out? Why do the steel liners or shims of the equalizers break into pieces? Why do the enginemen and firemen all over the world keep up a continual howl about rough-riding engines? Because the locomotive designers do not know anything about the action of the springs when the locomotive is at high speed.

J. HECTOR GRAHAM.

Boston, Mass.

[With all due respect to Mr. Graham's opinions about equalizers, we insist that he is mistaken. Rough-riding locomotives are found all over the world; but the writer's experience is, that rough-riding is the rule with engines which have no equalizers, while it is the exception with those having that appliance. The engines Mr. Stewart complains of are not equalized.—Ed.]

Rhode Island Locomotive Works.

It is rumored that the Rhode Island Locomotive Works have been bought by Mr. Leiter, of Chicago, who will be remembered in connection with the recent great wheat deal. He is said to represent a number of Chicago capitalists who have also bought the Wheelock stationary engine patents and are to manufacture both locomotive and stationary engines on a large scale.

The works should employ about a thousand men, and ought to help revive the flagging mechanical industries of Providence.

If you have made up your mind to study a little during the winter months, send for our book list. It will help you in making a selection.

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What We Saw in Russia.

Among many people who interest themselves in the growth of Russian industries there is a belief that the country is rich in accumulated wealth which has been for years waiting to be embarked in manufacturing enterprises. Nothing could be farther from the truth. Russia is naturally one of the poorest countries in the civilized world, and it would be difficult to find a country possessing so few of the elements necessary to build up an industrial community.

It is essentially an agricultural country, and its riches depend almost exclusively upon the products of the soil. In some places the soil is said to be naturally fertile, but the regions which we traversed showed very meagre signs of yielding bountiful rewards to the farmer. The country is very flat, with vast areas of forest and morass. In many respects it resembles the poorer regions of Indiana. European Russia is about sixty times the area of the State named, and has forty inhabitants to the mile; while Indiana has 60, and is thinly settled at that.

The principal topic of conversation among the foreigners residing in Russia, for the purpose of profiting by the growing activity in the arts and manufactures, is the great enterprise of the rulers in fostering and promoting industries. We are familiar with the expression, "Hurrah for the old flag and an appropriation!" The enterprising foreigners in St. Petersburg who are beaming in the sunshine of forced industrial progress say, "Hurrah for great Russia and a concession!" Many of the American, English, French and German people you meet with in Russia are laying wires to obtain a concession of a monopoly in some line of business, and others are working the wires that were laid months or years ago. Among the people thus employed there is a great deal of rivalry that is not of a high-principled character. Some of them have what seems friendly social intercourse together, and at the same time abuse each other when talking to others. The insulation which people experience when they constitute a small entity in a foreign country seems to exercise a demoralizing effect on their natures.

Nearly all the foreigners who are trying to secure trade orders in Russia have a great deal of evil to say about the corruption of officials and others. The experience we have had with American railroad supply men makes us very cautious in believing tales of bribery and corruption. A crowd of rivals are striving to obtain a certain order, and nothing seems more natural than for some of those who have failed, to say in their wrath that the man with the longest pole takes the persimmons; or, in other words, the longest purse gets there.

In a country with over ninety millions of inhabitants, to say nothing of the millions in Asiatic Russia, there must be for many years a demand for machinery and artizan products that will be beyond the manufacturing capacity of an agricultural community. A belief is common that in the near future Russia will be in a position to produce all the articles required for its own use; but the chances are very much against this consummation so much desired by the Russian Government.

Every possible means have been resorted to by the Russian Government to supply artificial stimulants to industrial progress, but I think the problem has been begun at the wrong end. Ever since the time of Peter the Great, who reigned about 200 years ago, the sovereigns have followed the policy of encouraging industries by a policy of high protection; but they have done very little to elevate the agricultural masses to the plane that supplies intelligent and self-relying workmen. The great mass of the people are engaged in agricultural pursuits, and almost nothing has been done to give them even elementary education. About 12 per cent. of the people live in towns, and even these obtain very small educational privileges. It is said that not more than 6 per cent. of the entire population in Russia can read, and everywhere a traveler finds evidence that the popular ignorance of letters is acknowledged, and all possible provision made to render its inconvenience as small as possible. In the towns the fronts of all the stores are decorated with paintings indicating the kind of articles for sale inside. The baker shows pictures of all kinds of bread; the butcher, the parts of animals cut up in the shape likely to suit customers. The milkman has a cow with a maid drawing forth the product of the udder; while the grocer has pictures to show the varied assortments in which he deals. The tailor never fails to have the painting of a dress suit, with a variety of more humble garments; and the shoemaker excels himself in the variety of boots, shoes and slippers portrayed. All other trades, including those who sell machinery, follow the same practice. The front of the machinery store of Mr. T. Smith, American Consul in Moscow, is an interesting study, for all kinds of American machinery that can possibly be crowded in have a place in that picture gallery.

Railroad companies have been compelled to resort to the same graphic practice to indicate the different classes of carriages. They do not exactly paint on the first-class the picture of a prince, on the second-class the picture of a business man, and on the third-class the picture of a mujik with hayseeds in his beard, but they paint each class a distinct color, which indicates at a glance which compartment the various classes are safe to enter.

In all countries except Russia, the inspirations of industrial progress have moved from below, and have grown naturally to meet the needs of the community, or to keep pace with the growing skill and enterprise of the artizans and manufacturers. In Russia the stimulus to the developing of an industrial nation has come from the top.

Peter the Great, who was imbued with the ambition of converting hordes of barbarians into an industrial nation, started the movement to develop native industries. His example has been followed by all the sovereigns of Russia since his time, but the success achieved has not been commensurate with the efforts made. The secret of the failures, in my opinion, has been that they thought that a man without mental training could be guided into doing work mechanically that required the exercise of developed intelligence.

In Russia there are practically only two classes, the nobility and the peasants (called mujiks). Peter the Great, Catherine II and other monarchs used great efforts to establish a middle class, called in English-speaking countries "burghers" and in France "Bourgeoisie." In the development of European countries this burgher class, which lived in cities and carried on trade and commerce, had been a buffer between the conflicts of sovereigns and nobles, and did very valuable services in conserving human liberty and in promoting the prosperity of the countries where their influence was exerted. Several of the Russian monarchs recognized the salutary influence exerted in other countries by the burghers, especially Catherine II, and they tried to engraft the institution upon the Russian body politic; but the conditions were not favorable to this new class, and in spite of two centuries of assiduous cultivation, it is still a very fragile member of the Russian political family.

To explain this failure of good intentions, it is necessary to make a brief review of Russian history, which in many respects is radically different from the history of any other country.

Those who are familiar with the history of the world are aware that certain "races" have shown peculiarly strong characteristics which have given them extraordinary influence in the development or the retardation of civilization. The best known is the race of Abraham. That stock has been unparalleled in its power and vitality. Next to that, as familiar to us, is the Anglo-Saxon race, a combination which has developed wonderful law-giving genius. Next in influence is the Norman race, which imparted to the Anglo-Saxons their governing qualifications, and were absorbed, so far as Great Britain was concerned, by the conquered. This is given as an introduction of some particulars about the Slavonian race, which constitutes the greater part of the Russian people.

When the colonization of a great part of the world was in its infancy, three or four thousand years ago, there grew up in certain fertile valleys of the Carpathian Mountains, in Austria, a race now known as Slavs or Slavonians. Whether or not they proceeded from one ancestor, such as Abraham, is not known; but it is certain that they grew and multiplied with remarkable fecundity, and that they possessed nation-making attributes. After the condition of the savage, the human race is believed to have progressed through several stages. The improved savage becomes a hunter, and when game becomes scarce, and the human mouths to feed exceed the supply of wild animals, he becomes a shepherd, doing his best to keep flocks and herds equal to meet the hunger demands of his followers. When the herds prove unequal to the task of feeding the people, resort is reluctantly made to tilling of the soil and the artificial production of food.

It is not known from whence the Slavs came; but they displayed wonderful ability for making a comfortable living from the fruits of the soil. Their language indicated that they belonged to the Aryan family, to which nearly all civilized nations belong, embracing such extremes as India and Great Britain.

These Slavs living on the fruit of the land in one of the most fertile regions of Europe made an easy living, and that resulted in the rapid propagation of their race. The increasing population needed elbow room, and they extended their peaceful conquests of the soil from the Western to the Eastern boundaries of Europe. No race had done more to convert Europe from a nomadic (moving about) to agricultural people. Their influence fairly established over wide areas, they entered upon the field of nation-making, and several countries in Europe have this race for their foundation.

These people extended into the unsettled prairies of Russia as far as the Ural Mountains, and began doing as much for the country as our pioneers did for Ohio, Illinois, Missouri, Iowa, Kansas, Nebraska and other states. They no doubt had a good time of it for years or centuries, until the land of that part of the earth began to get overburdened with people, as it seemed to be when our pioneers first were startled with the sound of a steamboat whistle.

The population of the old world was increasing faster than the inclination of the people to earn an honest living by labor, and we learn of waves of the North Eastern races pushing their immigration claims upon unwilling regions. Away in the times when Greek scholars and Roman philosophers were writing things that have become authentic history, they told that a Northern race of barbarians, called Scythians, and afterwards a race of Huns, had devastated the civilized world. These invaders came from North Eastern Europe, and were out for plunder.

In their early raids they did not pay much attention to robbing the land-tilling Slavonians; but as time went on, the need for easily procured food supplies made the land-tillers the victims of many marauders. There were Mongols from the East and whole nations from the West who found robbing the Slavonian agriculturists their easiest means of feeding their followers.

The Slavs in Russia established for themselves the most primitive form of government, which is the patriarchal. The head of the household is the first ruler, and when households multiply, it is necessary to choose a chief, who rules all the households. At first this chief was elective; but here, as in all other countries, that began with clanship; a family in time arises which claims the ruling power by right of succession. So by degrees every district in Russia fell under the rule of petty princes, who were often at war with each other and offered no effective defence against the inroads of outside despoilers. Over and over again the whole country was devastated, so that wide districts were depopulated. Those who are familiar with the history of the Scottish Highlands will readily understand how closely the analogy was between clanship in Russia and the same form of government in Scotland.

While all other nations in Europe had settled under orderly governments and were making progress, not only in agriculture but in the arts and sciences, Russia remained for centuries a region of rude husbandmen with no rope to bind them together.

It took a long time for one territorial prince to rise sufficiently above his fellows that he was able to unite them under one ruler. Attempts of this kind were made repeatedly, and certain princes became for a time rulers of the whole country or large parts of it; but after their death the old condition of anarchy returned. During these brief periods of central government many internal improvements, such as the building and fortifying of cities, were carried out, which prepared the way for a permanent government of the whole country. The backward condition of Russia may be inferred from the fact that it was more than a century after America had been discovered by Columbus, that the first printing press was introduced.

It was not till 1613 that a member of the present reigning family was raised to the throne and established a line of rulers which has continued in control. The first Romanoff—the family name of Russian royal family—was said to be descended from a family of Normans who were invited centuries before to rule over certain parts of Russia and turn chaos into order.

The early Tzars did not have much time to devote to the amelioration of the condition of the mass of the people. It was all they could do to prevent the nobles from chasing them off the throne. Peter the Great who become Tzar in 1689 was the first monarch to pave the way for putting Russia on a footing with other nations. He was the originator of the policy which seeks to make Russia an industrial country; but he saw that the task of making workmen out of the ignorant peasants was hopeless and he adopted the policy of inviting foreign workmen and artizans to carry on the mechanic arts which he wished to cultivate.

When Peter began his work of nation making there were only two classes in Russia—the Nobles and the Serfs. The nobles were a proud, turbulent race that would do nothing to aid the Tzar's industrial schemes, and he did nothing to raise the standing of the class from whom workmen are naturally drawn. The artizans and learned men whom he brought from foreign countries made the nucleus of a middle class and all kinds of artificial means have been employed since Peter's time to fertilize the growth of this class, but to-day they are still so few compared with the other classes that their influence is unfelt. As they have no privileges of self government the burghers of Russia have no pride in their class and are of no value for good or evil.

The vital element in the Russian population is the mujik, or peasant. Until about forty years ago these peasants were all serfs; but as far as I can make out, the emancipation to freemen has done little to improve their condition. The greater part of them are engaged in tilling the soil, and they cannot leave their native villages without permission from the authorities.

Agriculture in Russia is carried on in a very different way from what prevails in other countries. There are no farmhouses to be seen. The land is divided up into large estates, and the people engaged in cultivating it live in small villages, called communes, in miserable-looking houses covered with thatch. A certain portion of the land is set apart for the use of the peasants. This the heads of the commune divide up into portions for each household, the amount of land thus assigned depending upon the number of "souls" in each family. A "soul" is the expression used to distinguish the male. Females are not considered worth counting, except when work in the fields is demanded. From the product of this land the peasants must support their families and pay their taxes, which are very heavy. The commune has an elder at the head, chosen by the peasants, and all matters relating to the village are managed by it. Questions are decided by popular vote, and appeals are never made against the decisions reached.

A household in a Russian commune is often very large. As sons marry they bring their wives to their father's house and there may be a dozen families under one roof, but there is always a head of the household who represents it in the commune.

For the use of the communist land each man and woman in the household with a horse for this unit of labor has to work for the proprietor three days a week. Besides this each household has to give to the proprietor certain dues in the form of eggs, chickens, lambs, linen and money. When a native of a commune gets permission to go away and work at a trade or other occupaion he has to send back a part of his earnings to hire others to do his work and to pay his taxes.

A disability which these peasants labor under is that they have to cultivate the land on a three years' rotation of crops, one of the three years calling for the land standing fallow. Those who hold communal land cannot depend on getting the same patch twice in succession, so there is no inducement to enrich the soil or to prevent it from deteriorating.

With all the disadvantages they labor under the Russian mujik is a sturdy, industrious, good-natured member of the human family and he deserves more encouragement than he receives. If the governments in the last two hundred years had done half as much to elevate the condition of the peasant as they have done in foster privileged classes, the country would be in a much better condition to enter upon the conflict of industrial competition.

While traveling in Russia one seldom sees a man working in the fields. That labor is nearly all done by women and it is a common thing to see women working on the track and at other kinds of labor that appear unwomanly. This is due in a great measure to the drain on the manhood of the nation made by the enormous standing army. The proposal made lately by the Tzar for general disarmament has called forth no end of ill-natured criticism in Europe and America, but I believe that the proposal originated in a desire to utilize the Russian soldiers for manning the railroads, the increasing manufactories, and to obtain more hands for the plow and the scythe.

When railroads were first opened in Russia there were practically no native artizans capable of performing the duties of operating the machinery or trains and foreigners had to be brought in to do the work. Since the first line was opened a systematic effort has been made to train native Russians for the various duties of railroad operating, and there are now comparatively few foreigners engaged in this work. A locomotive engineer in Russia is generally a technical school graduate, and all the other men holding responsible positions on the railroad would have gone through special training to enable them to perform their duties. Uneducated peasants are employed on the work calling for little knowledge, skill or intelligence, but they rarely rise above the mere laborer. A thing that struck me forcibly about the railroad workshops, stations and trains was the number of uniformed men who were acting in some kind of official position.

In Russia the descendants of every prince since the house of Romanoff came to the throne is a prince in his own right, and many of them have inherited nothing but contempt for ordinary labor. A starving scion of a decayed principality is too proud to push a file or even a drawing pen; but if he can bedeck himself in an imposing uniform and boss somebody he is back into the native element of his forefathers. That I suppose is why there are so many ornamental officials on Russian railways and in the industrial establishments of the country. A. S.

Turning Water Into Steam.

Readers of engineering literature are accustomed to come across such expressions as mechanical equivalent of heat, latent heat and heat of evaporation. For those who have not studied closely the principles of steam engineering, we will give some brief explanations of the terms, which may not be popularly understood, although all intelligent enginemen ought to be acquainted with them.

Steam the vapor of water, is the most convenient medium known for transforming heat, the potential energy of fuel, into mechanical work. The operation is usually carried on by means of the steam engine. According to the laws of thermodynamics, which are accepted as the gospel of steam engineering, heat and mechanical energy are mutually convertible; and heat requires for its production and produces by its disappearance mechanical energy in the proportion of 772 foot-pounds for each unit of heat. That factor, 772, is known as Joules mechanical equivalent of heat. The thermal or heat unit is the quantity of heat required to raise the temperature of one pound of water one degree Fahrenheit at a temperature slightly above the freezing point. As water increases in temperature, a slightly larger quantity of heat is required to raise the temperature one degree, owing to the expansion of the water and consequent disappearance of heat in doing internal and external work. At 400 degrees Fahr. the dynamical or work value of one degree is 800 foot-pounds. This fact should be borne in mind by engineers experimenting with high pressures of steam.

In most calculations relating to heat, engineers and scientists employ the heat unit as a basis of measurement. In ordinary engineering operations, the heat required to raise the temperature of one pound of water one degree at any temperature is calculated as a heat unit.

As a convenient means of noting the phenomena connected with the mechanical power developed by the conversion of water into steam, suppose we place one pound of water at the freezing point in a vessel convenient for measurement, and, applying heat, follow, observe and record the events of a cycle similar to that which steam makes in passing through the boiler and cylinders of a steam engine. Let us place the water at a temperature of 32 degrees Fahr. at the bottom of a glass tube of indefinite length, open at the top, and having a cross sectional area of one square foot—144 square inches. At the freezing point one pound of water measures 27.7 cubic inches, therefore the volume we are going to experiment with will cover the level bottom of the tube to a depth of .1923 inch. If now we apply the flame of a spirit lamp or other source of regular heat to the tube beneath the water, the temperature will begin steadily to rise until 212 degrees Fahr., the boiling point at atmospheric pressure, is reached. The water will then be gradually evaporated into steam, but the temperature will remain the same until vaporization is completed. If it took ten minutes for the heat of the lamp flame to raise the temperature of the water from 32 degrees Fahr., the freezing point, to 212 degrees Fahr., the boiling point, it would take nearly fifty-five minutes longer before the whole of the water would be converted into steam, and the thermometer would indicate no elevation of temperature for the great additional amount of heat expended. It takes nearly 5½ times the quantity of heat to evaporate one pound of water—or any other weight for that matter—that it takes to raise the same quantity from the freezing to the boiling point, and the great expenditure of heat is not sensible to the thermometer.

Philosophers have been accustomed to explain the disappearance of heat by saying that it became "latent" in the steam. The expression is ambiguous, and has led to much misapprehension of what really becomes of the heat when water is converted into steam. Physicists now give a more detailed explanation of the phenomenon.

There are certain exceedingly powerful molecular forces called chemical affinity and cohesion exerted by nature upon water tending to condensation, attracting the atoms into a close, tenacious embrace. The application of sufficient heat will have the effect of performing the internal work necessary to overcome the attraction of the atoms, a change of condition will be accomplished, and the water will be expanded into steam. The heat applied will do the work of tearing the atoms apart and in keeping them for a time in that condition. Still further application of heat under proper conditions would have the effect of separating the constituent gases of water. The process of expansion into steam is obstructed by outside resistance, principally by that presented by the pressure of the atmosphere. The work performed against the latter influences is called external work.

When the heat was applied beneath our tube the power of the flame was first devoted to raising the temperature of the water, and 180 heat units were expended in this manner augmenting the temperature from 32 to 212 degrees Fahr. The heat continues to pass into the water, and steam is gradually formed, boiling goes on, and when the last drop of the water has been evaporated, 966 heat units, besides that used to heat the water, have been expended, making a total of 1,146 heat units, which is known as the total heat of vaporization. The degree of heat that has been insensible to the thermometer, viz., 966 heat units, is often spoken of as the latent heat of steam at atmospheric pressure.

More Pooling of Locomotives.

One of the latest railroad companies to adopt the pooling system of running locotives is the Atchison, Topeka & Santa Fé, and the change has brought much discontentment and resentment to the men who are deprived of their pride of individual interest in certain locomotives that have become objects of love and admiration. This change towards pooling, and therefore divorcing the affection and interest of the enginemen from particular locomotives, is the prevailing tendency of railroad companies, and enginemen of the Santa Fé must fall in line with as much resignation as they can muster. We have never believed that the practice of pooling locomotives was economical to railroad companies; but the tendency is in that direction, and no words of ours can stem the tide. With individual engineers and firemen assigned to certain locomotives, the mileage performed by each machine is smaller than under the pooling system; but we believe that the work can be done so much more economically under the old system that the saving would more than pay for the extra capital necessary to provide a locomotive for each crew.

On certain railroads the pooling system has worked fairly well, while in others it has increased the expense of train operating, while leading to annoying delays from engine failures on the road. This has been due to the manner that the pooling system was carried out. It originated on the Pennsylvania Railroad, and there the officials in charge recognized that something more was needed to make the system a success than merely letting the men whose turn it was to go out take the first locomotive ready. They understood human nature sufficiently to know that a man who was not running a locomotive regularly could not be fairly held responsible for reporting the work necessary to be done on the engine, and they inaugurated a plan of systematic inspection that led to the engines being maintained in good condition. They did not insist on the fireman spending his time off the road in polishing and cleaning engines that he might not make a trip on in a month. Under this policy the pooling system worked fairly well, so much so that other railroads adopted it.

For the last twenty years various railroad companies have adopted the pooling system. Some of them have abandoned it and tried all sorts of modifications, without satisfactory results. The trouble with railroads that imitate Pennsylvania Railroad practices is that they adopt a part and imagine that they can get along without other parts which are really essential to success. The most prominent mistake made about the pooling system of locomotives has been that the officials supposed that they could dispense with the system of inspection and hold the men responsible for reporting the defects of engines they had only run for a single trip. No amount of disciplining the men could make this a success, and it merely led to a condition of antagonism between the enginemen and the officials, which is a very expensive thing for railroad companies.

Our advice to railroad officials who are determined to adopt the pooling system is, to find out the rules under which locomotives have been run that way successfully and adopt them.

Buyers' Finding List.

After carefully considering both sides of the question, we have decided to abandon the "Buyers' Finding List," which has been a bone of contention in too many instances. As was announced when it was inaugurated, it was not a part of the advertising contract, but a voluntary contribution of space on our part, which we now believe will better serve the interests of all concerned by being devoted to live reading matter; over twenty pages a year.

It is impossible to make the "Buyers' Finding List" complete without giving each advertiser a heading for every article he manufactures or sells, even though he pays for but an inch of advertising space; which is, of course, impossible, as the space so used would far exceed the space occupied by the advertisement. The only way, to be fair to all concerned, seems to be to discontinue the "Buyers' Finding List," and this we have decided to do, beginning with the January issue.

In our Correspondence Department appears a letter with the caption, "Apprentices on Piece-work," which treats of a subject which we consider very discreditable to the railroad men responsible for it. At the last two or three Master Mechanics' conventions there was a great deal of talk about devising means for improving the conditions of the apprentice, and giving him improved opportunities for learning his business. The sentiment of every meeting seemed to be in favor of doing all that could be reasonably desired to improve the condition of the apprentice, and yet here is one of our great railroad companies putting their apprentices on piece-work. Whatever may be said in favor of piece-work in a general way does not apply to an apprentice, and the manager who takes on an apprentice and puts him to work at piece-work, deliberately takes away the boy's chance of learning the trade properly.

A Hint to Publishers.

The use of the card system of indexing and filing matters for future reference is growing so largely that it will probably pay publishers and others to recognize it more fully.

A recent convention of chemists in Washington decided to request publishers of chemical books to send out announcements of their new publications on cards or paper of such size as to be readily filed in the card index drawer for reference.

This size is, unfortunately, a metric dimension, but is approximately 3 by 5 inches, being about 1-16 of an inch less in each direction. This seems to be a good hint to those who sell goods of any kind to engineers or others who keep a card index, and this means a larger number than many people think.

A recent patent is for a headlight, to be so mounted that it will turn as the truck turns, and throw the light on the track more uniformly. We are afraid the necessary arms, levers and other jiggers will prevent its universal adoption.

BOOK NOTICES.

"The Story of the Railroad," by Cy Warman. Published by D. Appleton & Co., New York. $1.50.

This is a somewhat different line from Cy Warman's other books, and, as its title indicates, is a story of the progress of railroad building in the West. It begins with the origin of the idea of westward lines, tells of their early explorations and surveys, the road-building and the tombs of the trail makers. It is needless to say it is not dry description; the author's name indicates its readable character, and the numerous incidents, anecdotes and conversations lend added interest to it. The privations—often death—of the pioneers in the work, the fight with Indians, life in the camps, the hardships of the Rocky Mountain campaign—if it can be so called—show a side of the character of civil engineers and construction men that is seldom thought of, and show how true it is that there are more heroes in everyday life than we dream of. It is useless to attempt describing the book further. The reader, whether railroad man or not, is sure to be interested in both the text and the illustrations, which are of high grade. It should have a large sale.

"Railway Economics," by H. T. Newcomb. Published by *Railway World*, Philadelphia, Pa. $1.00.

This is republished from the *Railway World*, and includes a consideration of transportation, capitalization, income and expenditure, rates and prices, competition, reasonable rates, discrimination, consolidation, pooling, taxation, construction and numerous other points in connection with the question. The author is chief of the section of freight rates in the U. S. Department of Agriculture, and also Instructor in Statistics and Transportation in the Columbian University. This should qualify him for such a work, and we have no doubt the statistics quoted are correct. There is much to be said on both sides of the question as to new construction of roads, and there is no doubt that the building of a parallel line often demoralizes both the old and the new, injuring the public as well as the roads. Yet it is a delicate matter to suggest that competitive lines should not be built. The author handles the subject in a clear and interesting manner, and the book should be appreciated.

"Compressed Air Production," by W. L. Sanders. Published by "Compressed Air," New York. $1.00.

In the fifty-eight pages, of approximately 6 by 9 inches, the author treats of the different systems of compressed air production, showing the machines and compressors used for the purpose. It also contains numerous tables and diagrams which should make the subject clear to anyone interested, and we are sure anyone using air in shop or other work will find much of value. The increasing use of air for various tools in shops and roundhouses makes this a timely book on the subject. It is to be regretted, however, that better cuts were not used.

Privileges and Duties of American Enginemen.

In the course of an address before Vanderbilt division 145, New York, of the Locomotive Engineers' Brotherhood, Angus Sinclair described the condition of enginemen in Europe in a way to make all his hearers thankful that they were running locomotives in America. There is no piece-work system among the enginemen in Europe. Results in the form of taking a train a certain number of miles is not the basis of pay. Time is the basis of remuneration, and all trainmen are paid by the day, week or month. The duration of a day's work varies from ten to twelve hours, and the reward for that long stretch of time spent upon the footplate or in the way-car varies from 75 cents to $2 a day. The pay of a first-class engine driver is about the same as that of a first-class machinist.

Besides being underpaid for the kind of work they have to perform, enginemen in foreign countries are subjected to numerous petty annoyances which make their lives far from being a round of celestial joy. There are fines inflicted for every small violation of rules that are numerous as the words of the moral law.

That American enginemen are not reduced in wages and in general treatment to the same level of foreign enginemen is due principally to the self-protection offered by the Brotherhoods. Railroad managers, as a rule, are perfectly willing to maintain the high standard of wages paid to enginemen; but some of them would like to make sweeping reductions, and then others would be compelled to follow suit; for the road paying the low wages could beat the others in the struggle of competition for low rates. A move of that kind would not benefit railroad companies any, for rates of transportation would keep pace in falling with the reduction of operating expenses. Low wages is a curse to any country, and any influence which tends to keep up wages in America is a benefit to the community at large.

The American people appreciate this so thoroughly, that the force of public opinion is always on the side of the wage-earner when an attempt is made to cut down his pay, and that public opinion is powerful enough to appall any railroad manager who is unwise enough to attempt a reduction of wages. Between the power of the Brotherhood wisely used and the sustaining force of public opinion, enginemen may rest assured that their wages is protected by a bulwark that no railroad magnate can break down.

Being the best paid enginemen in the world, American engineers and firemen ought to do their work better than the enginemen of any other country; but they do not. A railroad man traveling in Great Britain cannot fail to be struck with the skill displayed in firing, which is greatly in contrast with the practice on nearly all our railroads. So far as locomotives are concerned, there is no smoke nuisance in Great Britain, and that desirable condition of affairs is due solely to the care and skill of the firemen. If any of you have seen an automatic stoker feeding coal to a furnace, you would notice that there was no smoke. The reason of that is that the coal is fed continuously, and there is no big body of fresh coal dampening the fire sufficient to permit part of the fuel gases to pass away unconsumed in the form of black smoke. A fireman ambitious to do his work properly can prevent smoke by imitating, as nearly as he can, the automatic stoker. If he keeps up the fire by throwing no more than one or two shovelfuls of coal at a time, and scatters it thinly over the surface of the fire, there will be no more smoke coming from the smokestack than there would be if the engine was burning hard coal.

Vaudeville on the Lehigh Valley.

One of the saffron journals of New York recently exploited with all the tints of the spectrum a vaudeville entertainment given on board a Lehigh Valley passenger train. Through the courtesy of genial Charles S. Lee, the general passenger agent of the Lehigh, we present the facts of this innovation in railroading. The train was a special, made up for the use of delegates from New England, New York and the South, to the forty-third annual convention of the American Association of General Passenger and Ticket Agents, at Detroit, in October last.

The idea was to make the trip as enjoyable as possible, and also one to linger in the memory of the participants even as a pleasant dream. A vaudeville show was the means by which both objects were accomplished, and the dining car was taken for an auditorium by removing the tables and placing the chairs in rows, by which the ladies, about forty, were all seated, leaving ample space for the gentlemen to dispose of themselves. A piano at one end of the car did duty as an orchestra, and everything was thus ripe for the vaudevillers. Mr. Marshall P. Wilder and others furnished fun in the way of monologues and recitations. There were songs, pathetic and comic, and also Professor Ransom in the "Black Art." After over two hours of solid fun, the tables were arranged for a progressive euchre bout, to wind up one of the most unique and enjoyable entertainments ever conceived and carried out on wheels. The Lehigh Valley has taken the initiative in a scheme that may be demanded by the traveling public as a regular feature of their service.

The Oldest Scotch Locomotive.

We are indebted to Mr. Sam. A. Forbes, of Perth, Scotland, for the photograph from which we made the engraving of the small four-wheel engine shown. The engine is used on the North British Railway still, and is supposed to be the oldest locomotive run in Scotland to-day. It is so old that no one on the line knows when it was built. It was rebuilt as far back as 1867.

Cylinders are 15 x 24 inches; driving wheels, 63 inches diameter, and the boiler has 813½ square feet of heating surface. The total weight of the engine is about 50,000 pounds.

Rhyming Engineers at Odds.

Several years ago when John A. Hill was running the business end of Locomotive Engineering, he conceived the idea that a poem from Shandy Maguire advising the boys to subscribe for the paper would have a stimulating effect on the subscription list. Mr. Hill wrote to Shandy asking if he would write a poem and in reply received an answer that if the J. P. would give the ideas he wanted embraced into rhyme, the verses would be forthcoming. The J. P. accordingly sat down and dictated a letter to his stenographer, outlining the ideas for the poem and ended up the letter by saying, "Now turn your muse loose upon that and it will be all right." When Mr. Hill got the letter to read from his stenographer, it read, "Turn your mules loose upon that." The poem went on:

"The days of the 'ballahoos' are o'er,
  And the men that ran them too;
Hereafter the throttle and furnace door
  Require an enlightened crew.

The boneyard's full of the ancient 'quills'
  That chewed up the blocks of wood;
Heaven rest their souls, they were crazy
    'mills,'
  And were noiser far than good.

Now, my boys, the modern giants roll
  O'er the ponderous rails of steel,
And to measure them out the steam and
    coal
  Is essential to your weal."

Last month when the S. P. was making a tour among enginehouse and railroad offices, he was shown a copy of the old circular with the following verses written on it by Winn Powell, an old engineer of the Illinois Central:

"Your fanciful giants with each modern
    appliance
  And no money spared to erect them
May be run by the boys, but those ancient
    machines
  Needed sensible men to direct them.

Oh! Shandy Maguire, you're a terrible liar
  When you talk so about the old-timers,
For boys knew how to fire and handle the
    flyer
Before men lost their heads and turned
    rhymers.

You talk about measuring fuel and steam;
  Oh Shandy, get out with such bother;
I think that you must have seen snakes in
    your dream,
  For such nonsense would tire a mule's
    father."

The 1,000 steel cars which the Pennsylvania has ordered from the Schoen Steel Car Company will weigh about 34,000 pounds each, or altogether 34,000,000 pounds. This means an immense amount of steel and iron, and shows where the bulk of the output of the steel plants goes to. These 1,000 cars, holding 100,000 pounds each when loaded, would represent a total weght of 134,000,000 pounds. The old-style hopper bottom wooden coal cars had a capacity of 60,000 pounds, and weighed about 34,000 pounds each, and their total carrying capacity was 6,000,000 pounds, whereas the total carrying capacity of the 1,000 Schoen steel cars will be 10,000,000 pounds, which shows a gain in load of 4,000,000 pounds, without any increase in the dead weight. These facts alone speak well for the future of the steel-car industry, and it only remains to demonstrate their further economy by a practical test of their durability, and then the day of the wooden car will be over.—*Pittsburg Post.*

AN OLD SCOTCHMAN.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

The Air-Brake Situation.

The Westinghouse Air-Brake Company authorizes the following statement in regard to the New York and Boyden Companies:

The purchase of the Westinghouse Air-Brake Company of the patents and business of the Boyden Brake Company is the final conclusion of a long and interesting litigation relating to air brakes.

The course of these suits has been followed with interest by railroad men, because to a considerable extent they involved the right of the Westinghouse people to the sole manufacture of what is known as the "quick-action" brake. By the purchase of the Boyden inventions, which the Supreme Court said were highly meritorious, the Westinghouse Company still claim to control the situation, although this is contested in the United States courts by the New York Air-Brake Company. The Westinghouse Company have been successful in compelling the New York Company to cease making three different forms of brakes, and they claim that a fourth one which they are now putting on the market is also an infringement of their patents. This question will be finally determined by the Court of Appeals, probably in November or December, the opinion of the lower court having been favorable to the New York Company. Should the decision be favorable to Westinghouse, then the New York Company will once more be enjoined, and prevented from making their present style of brake.

In addition to this particular suit, it appears that the Westinghouse people have brought three other suits against the New York Company, and it would therefore look as if litigation between these two concerns was to be, if anything, more protracted than that between the Boyden and Westinghouse Companies.

Hard-Turning Rotary Valves.

Last month we asked readers who had devices or schemes for easing up a stiff working rotary valve to write us, giving the methods employed. We have had several replies, from which we gather that vulcanized fiber and white metal used in metallic packing rings, made into rings to go between the rotary key and valve cap, are giving very good service. There is little doubt that the greater part of the difficulty with a stiff working rotary valve lies in the ring or washer between the key and the cap, and will disappear if properly looked after.

Care in Fitting Pump Bushings.

In fitting upper air valve bush in the 8-inch pump, too much care cannot be taken to make the fit so that the two brass bush shoulders against the cast-iron pump body, and the cap nut on top of bush and cast-iron body—all four of the joints—shall be made simultaneous. Too many repairmen are content to nicely seat the bush shoulders on the cast iron, then file off the top of the bush, so the shoulder of the cap nut will seat on the cast iron. Ofttimes too much is filed off the top of the bush; but is not noticed, as the shoulder of the cap nut seats. Then all that holds the bush to its seat is the small set screw, which ofttimes fails, its office being to merely keep the bush from turning, and the refitted bush is loose, causes heating, and is no better, probably worse, than the old bushing.

A Good Book Out of Print.

During the past year or so we have had many inquiries from correspondents concerning the 1895 Proceedings of the Air-Brake Association's St. Louis Convention. The book is one of the best gotten out by the Association, but unfortunately only two thousand copies were printed, and sold nearly within a year. Those who possess copies will know that they have a rare and valuable book; but if anyone has a copy they would like to dispose of they can get rid of it by writing this department.

The book contains some valuable information, and having been compiled some time ago, it would seem that the Air-Brake Men could advantageously go over the subjects again, and, with the knowledge and experience since gained, could make even a more valuable book than the original. This plan would also place the desired information in the hands of persons who are now unable to get the book.

Answer to Puzzle.

Editors:

Replying to the puzzle in last month's Locomotive Engineering, on the lost discharge valve, I would say that it was replaced by the lower receiving valve, and air was furnished by the up stroke only. This change of air valves could, of course, be effected in the 9½-inch pump, where all valves are same size and same lift; but could not be effected in the 8-inch pump.

S. J. Kidder.

Chicago, Ill.

Faulty Signalling.

A common faulty practice with passenger-train crews on the road and inspectors testing the brakes in the yard, is to hold open the signal valve too long. It is a familiar sight on passenger trains to see the conductor or brakeman holding onto the signalling cord with half his weight, as though the harder he pulled and the longer he held the valve open, the better signal he would communicate to the engineer. How often do we see the inspector testing the brakes on the train a few minutes before leaving time, step up on the rear platform of the last car and signal the engineer to release brakes. The signal is usually four or five blasts. The inspector generally makes the first blast fairly well, the second is longer, the third longer still, and the fourth usually draws out all the pressure remaining in the pipe.

Both of these men evidently believe the longer and harder pull insures a better signal. This is a mistaken idea, and air-brake instructors will do well to show up forcibly this wrong practice to train crews and inspectors.

Air-Pump Repairs.

A common error with air-pump repairmen in overhauling a pump is to consider the repairs full and complete when new packing rings, new air valves and perhaps a new reversing rod have been supplied. One of the principal parts thus neglected is the fit of the reversing slide valve rod in the bush and top cap nut. Unless these parts are well fitted, the live steam in the reversing slide valve chamber will leak out into the exhaust and carry with it the oil which should go to the reversing piston. As is well known, a dry reversing piston will cause a tardy reversal of the stroke and the pump to pound. It would therefore be good and profitable practice in overhauling an air pump to see that the reversing rod fits snugly in the cap nut and bush.

Any person having a copy of the Air-Brake Men's 1895, St. Louis, Proceedings which they wish to dispose of, can get rid of it by writing this office.

It is reported that the chairmen of the Air-Brake Association committees are getting an early start on their reports, and we may therefore expect a good air-brake book in their 1899 Proceedings.

CORRESPONDENCE.

Who Slides Wheels?

As the seasons whirl around, the good weather for ducks has changed to that of conditions favoring a good crop of slid-flat wheels. As the time of year has come when some wheels begin to assume a rectangular appearance, as if about to perform the geometrical feat of "squaring the circle," it might be in order to call the attention of engineers and others equally interested to some ways by which wheel-sliding can be largely avoided.

In the first place, let me say to those suffering from this malady and laboring earnestly for its prevention, that they are not alone—there are others.

It sometimes gets in print that such and such roads do not know what a slid-flat wheel is. Let me ask the reason why they do not know. Is it because they use only steel-tired wheels in passenger service, and the loss from turning down slid spots is not charged up to the wheel-sliding account? (I say in passenger service, because there is where the greatest percentage of sliding occurs). If cast wheels are slightly flattened in passenger service and then removed and placed in freight service, is a charge made against slid-wheel account? While I think the practice of transferring slightly flattened car wheels from passenger to freight service is a good one, yet a charge should be made against passenger service for their removal at least. Small flat spots appearing in the early part of the winter are very apt to be increased in size, if the wheels remain in passenger service, until they are beyond the limit of safety, to say nothing about the unpleasantness of their dull thud to the occupants of the car. In freight service the chances are greatly in favor of their soon rounding off and the wheels giving a good mileage.

Are these roads who don't know a flat wheel when they see it, braking up to fully 90 per cent. of the weight of passenger equipment? Of course they are doing this, as the law would go hard on them if it were shown that some accident occurred on a train lacking proper percentage of braking power. But is the force of shoes against wheels all that determines the stopping power of a train? Should we take into consideration what kind of brake shoes are used? Suppose some road should change from a soft cast-iron shoe to a harder one, and without any alterations in leverage, thereby prevent wheel-sliding, would any practical railroad officer say that the braking power had not been changed? Have no roads done this?

Can a road that has all six-wheel truck cars with but two pairs of wheels braked make the same time as a competing line with full power on all wheels and run no greater risk of wheel-sliding?

Perhaps this is a point that would appeal to railroad management, and here is another: How does the ballast affect the condition of the rail? Do mud, clay, cinders and coal screenings make a better rail than gravel or stone?

Is there any credit side of the slid-wheel account? Does shortening up the time of fast local trains "just a few minutes" in any way affect the liability of wheel-sliding? Is it generally known that it takes nearly three times as far to stop from a speed of sixty miles per hour as from that of forty, with the same power applied in each case? Is it generally known that to stop in the same distance, over three times the pressure would be required in the brake cylinders?

These questions are asked simply to bring out thought on this subject, with a view to interesting the operating as well as the mechanical department in this item of wasteful expense.

Observation has shown the writer that, as a general rule, engineers who are poorest handlers of the air brake and most wasteful of their pressure, and those who use the most sand—even at the point of waste, many times—are the least often guilty of wheel-sliding. In the first place, repeated applications and releases have so reduced their available pressure that there is too little left at the last to cause sliding. In the other case, the habitual user of sand stops with a lighter application, as a train runs harder on sand, and, too, after his brakes are set he does not unexpectedly run onto sand previously laid by some man pulling out of the station he is approaching, which is apt to occur on a single track.

But a few years ago, if you asked a number of passenger engineers how they would make a stop on a slippery rail, with rare exception they would say, "Begin farther back than usual and use sand." To-day when the speed of passenger trains is being constantly increased—so much so that in many cases time can barely be made on a good rail—it is easy to see that more time cannot be taken in making these stops when the rail conditions are unfavorable.

While the old saying is "More than one application is a waste of air," my motto is "Sliding is a waste of wheels" to the tune of nearly $10 per pair; therefore, how much air will $10 buy?

My conclusions are, for fast runs, a man should run in close to stations, use sand continuously while stopping on a slippery rail if the sand pipes can be kept open or a side wind does not blow it off; but, at any rate, make his first reduction heavy, about 15 to 18 pounds, and after slowing the train down to fifteen or twenty miles

ONE PAGE FROM THE LEDGER OF A BIG ROAD.

Dr. *Slid Flat Wheel Account.* **Cr.**

Oct.	15	100 Cars Sand (mostly Gravel and Clay) @ 50c.	$50	00	?
Nov.	1	100 Pairs Steel-Tired Wheels turned off—Loss of Metal. .	500	00	
Nov.	10	15 Pairs Cast Wheels removed (since shortening up time on Nos. 11 and 12 on Nov. 1st) @ $10.	150	00	
Nov.	15	10 Pairs slid on mud ballast on Mud Valley Division @ $10.	100	00	
Nov.	20	40 Pairs slid on the slack ballast, Coal City Branch.	400	00	
		&c., &c.			

an hour (and at a point where there is perhaps a slippery highway clossing), release and bring the handle back to lap, making a second and lighter application after all cars have had time to entirely release.

The success of this method comes from the fact that the heaviest braking is done when the train is moving at a high rate of speed and wheels will not slide, while on the tail end of the stop the pressure is so light that it will not cause sliding. Engineers who have never systematically tried this are surprised to find that rather less time has been consumed than in stopping on a better rail with one application of two or three light reductions. This latter method is theoretically good braking, but on bad rail is practically sure of wheel-sliding with cars and shoes of proper braking power.

One thing more: As trainmen should be also interested in the prevention of loss to the company, what harm would come if superintendents should issue the following bulletin, or if it should creep into the Book of Rules: "Trainmen must carefully watch the wheels in their train, and every time they notice them sliding they should immediately pull the air signal cord and hold the valve open until the wheels stop sliding. When an engineer receives one long continuous blast of the air signal whistle while the train is being stopped by the air brakes, he shall understand that some of the wheels are sliding and shall immediately release all brakes and set them more lightly, unless it would be absolutely dangerous to do so."

E. W. Pratt,
Gen'l A. B. Insp., C. & N. W. Ry.
Chicago, Ill.

A New Air-Brake Patent.

Editors:

I am sending you drawings and description of my new device for taking up slack in train with engine brakes before train brakes are applied, and also for holding engine brakes on after train brakes have been released, thus allowing the slack to run out gradually.

My invention consists in providing the rotary valve of the brake valve with certain cavities and its seat with a port leading through the valve casing and connected by pipes with the exhaust port of the triple valve, enabling pressure to be applied to the engine brake cylinder by way of the avenues of the triple valve ordinarily employed to open that cylinder to the atmosphere.

To the customary indicated operating positions of the engineer's brake-valve lever I add a "new-position" or "engine-service" demarcation, and upon moving the lever into the new position air from the main reservoir is admitted to the engine brake cylinder only, no demand being made upon the auxiliary reservoir, as in the regular "service application" of the train brakes.

Release of engine brakes set as described is effected by turning the lever into the proper "position while running." A suitable pressure-reducing valve mechanism is introduced between triple valve and brake cylinder.

Upon the drawings in Fig. 1 numeral 1 marks the engine brake cylinder, connected by pipe 2, including a pressure-reducing valve 3, with the triple valve 4. From the triple valve pipe 5 leads to train pipe 6, and pipe 7 to auxiliary reservoir 8. All the parts so numbered are of the customary construction and operation.

Train pipe 6 joins the engineer's brake valve 9, which has a circular valve seat 10, possessing the port 11, extended by groove 12; the port 11, leading to atmosphere; port 13, leading to the train pipe, cavity 14, and the remaining smaller ports required to carry out the regular operations of the air-brake system.

In addition to the usual ports, I have provided a new opening 15 between port 11 and cavity 14, leading through the casing of the brake valve and connected by pipe 16 with exhaust port 17 of the triple valve.

Fig. 2 shows the face 18 of the rotary valve having the customary large cavity 19 and adjacent thereto the relatively smaller port 20, also the groove 21 near the periphery and other ports or passages required to carry out the regular operations of the air-brake system.

In addition to the usual cavities I have provided two new ones between port 20

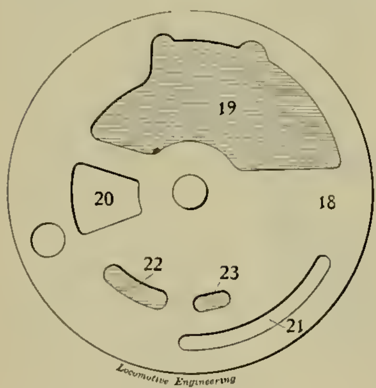


Fig. 2.

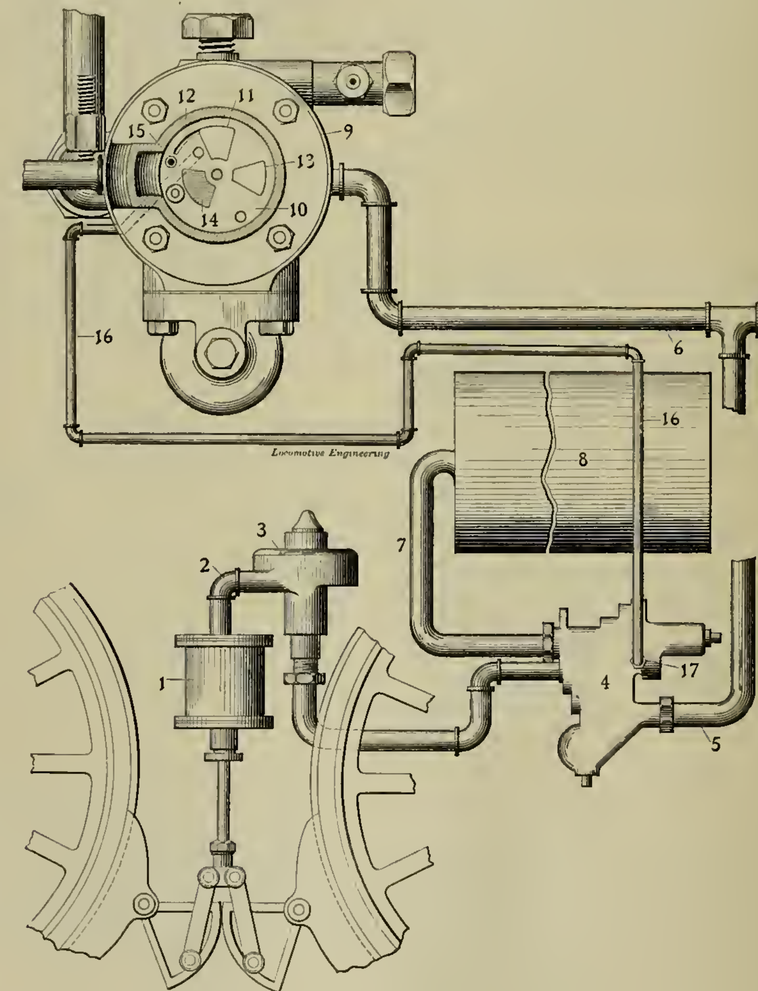


Fig. 1.

and groove 21; number 22 designating the larger and 23 the smaller cavity. Both are of similar oblong shape with parallel sides and rounded ends, and median lines drawn joining the ends of each interiorly would form portions of the same circumference described from the center of the valve face.

Probably my device may be criticised harshly, but while it is being under fire, it will make some smooth stops on the Pittsburg division of the P., C., C. & St. L. Ry., where it has been in successful test for some time past.

W. P. ALTER,
Engineer, P., C., C. & St. L. Ry.
Dennison, O.

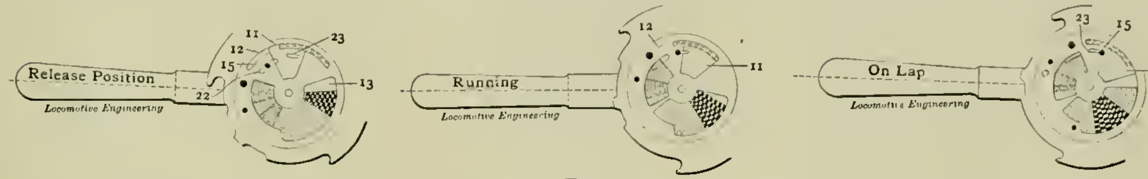


Fig. 3.

SHOWING RELEASE, RUNNING AND LAP POSITIONS OF ALTER'S NEW AIR-BRAKE DEVICE.

Good Repairs on Air Pumps.

Editors:

Your article on steam arrangement of 8-inch air pump, in November number, brings to my mind an article I saw in LOCOMOTIVE ENGINEERING a few years ago, giving information concerning the entire pump. I have followed this recommendation closely, and have had good results.

The road I am connected with use mostly 8-inch Westinghouse and a few 9½-inch pumps, and have very many stations on runs, using from five to ten cars on passenger trains, requiring a good airmaker. The service of pumps has been from eighteen to twenty-four months. I get good results from the following repairs:

We will take a pump after two years' service, take it apart and lye all parts off. After examining the pump, if we find cylinders worn 1-32 inch larger in diameter at ends than at center, we rebore these cylinders and make new piston and rings to suit. We always make one extra set of rings for next repair of this pump.

When reversing cylinder and main valve bushings can be bored by not increasing their diameters more than 1-64 inch above standard, we true them out. Nearly all pumps getting new pistons also get new reversing cylinder and main valve bushings.

In repairing upper head, both caps are made as near steam tight as possible on both bearings—that is, on upper head and bush—so as to keep pressure in steam chest, as a reversing valve bush might be called. We make recess in reversing cylinder cap 5-64 inch to secure required cushion on the up stroke of reversing piston, and also make reversing cylinder to tap down lightly on its taper bearing. We never rebore the reversing valve bush, but always renew it; also the valve, reversing valve stem, and cap, if worn badly.

In making a fit of reversing piston rings and main valve rings, I am careful to get a good bearing in cylinder by lapping the rings a very little, and main piston rings are fitted just tight enough so as not to be able to push piston back and forward in cylinder by hand, using a soft hammer so as to get a full bearing by the time the pump is run a short time on the test rack.

I am changing all main valves to standard length, and making distance from upper surface of center piece to main valve stop 25-64 inch as pumps come in for repairs. This change lengthens the life of reversing piston rods and main valve rods, also that annoying report of "Pump has stopped entirely, or disabled," when that ⅜-inch main valve stop is broken again, and allowed the main valve to drop out. We have increased this stop to ⅝-inch diameter, with ½-inch hole through center piece to overcome breakage.

Air valves of the 8-inch pump are given ⅛-inch lift for receiving and 3-32 inch for discharge. I am using steel end on valves, with good results; no breaking of discharge valve.

We also grind in our valve chamber bush in its place and adjust set screw so as to be able to move valve chamber bush slightly when set screw is tight, and see that cap is fitted nicely on air cylinder and bush. We also make lower valve cap screw fairly tight, so as not to get back pressure past the thread. I grind air valves with Trojan Grinding Compound, medium grade.

This gives practically a new pump; and by keeping parts as near standard as possible, we have good working pumps. The next time a pump comes in, I can true up reversing cylinder and main valve bushings, and use new rings in same and the extra set of rings made for main piston. We rebore this pump again, using piston No. 2, until cylinders are 1-16 inch larger in diameter than piston.

In general repairing of air pumps or other air-brake work, the closer all parts can be kept to the original or standard sizes, and work be done with care, the better results we will get, and cheaper it will be in the end.

F. G. SHAFFER.
Chambersburg, Pa.

Air-Brake Alarm Cock.

Editors:

I send you herewith a drawing and description of my patent, the object of which is to provide a new and improved air-brake alarm device which is simple and durable in construction, very effective in operation, and arranged in such a manner that the train-pipe cock and the cock for the signal-pipe cannot be closed without giving an alarm to the engineer and the conductor of the train on which the device is used.

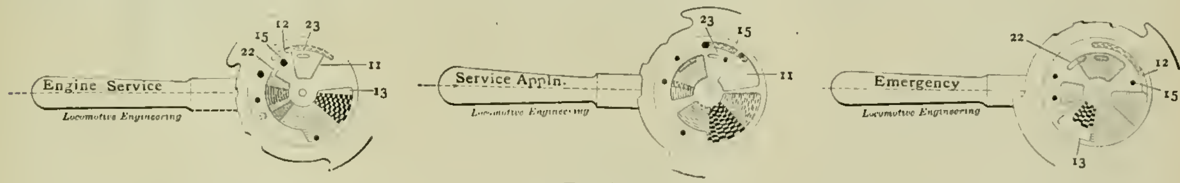


Fig. 4.

SHOWING "ENGINE," SERVICE AND EMERGENCY POSITIONS OF ALTER'S NEW AIR-BRAKE DEVICE.

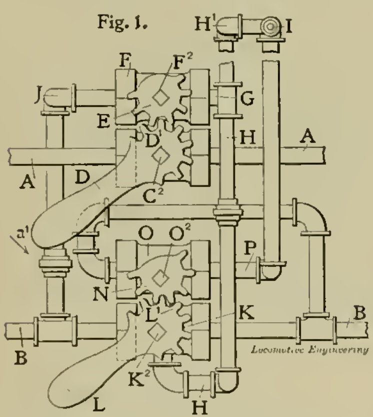
The air-brake system is provided with the usual train-pipe *A* and with a signal-pipe *B*, both extending from the locomotive to the cars in the usual manner. The train-pipe *A* is provided at the end of each car with an angle-cock *C*, containing a two-way plug *C'*, carrying at its stem C^2 a handle *D*, formed with a segmental gear *D'* in mesh with a segmental gear *E*, secured on the upper end of the stem F^2 of a plug *F'*, forming part of an auxiliary cock *F*, preferably cast on the angle-cock *C*, as shown in the drawings.

The auxiliary cock *F* is connected at one end by a pipe *G* with a pipe *H*, having a branch pipe *H'*, leading to the whistle or other alarm *I*, arranged in each car and on the locomotive in the usual manner. The other end of the auxiliary cock *F* is connected by a pipe *J* with the signal-pipe *B*. The plug *F'* stands at right angles to the plug C' of the angle-cock C, so that when the angle-cock plug is opened, as shown in Fig. 3, the auxiliary plug F' is in a closed position, and when the handle D is moved in the direction of the arrow a' then the angle-cock plug C' is shut and the other plug F' is opened to connect the pipes J and G with each other.

Now it is understood that when the angle-cock is in an open position, as shown in Fig. 3, the plug F' is closed, and when the angle-cock is closed for any reason or other then the cock F' is opened, so that air from the signal-pipe B can pass through the pipe J, cock F and pipe G to the pipe H, and from the latter through the branch pipe H' to the alarm I to sound the same. Thus the engineer as well as the conductor is at once notified that the angle-cock in the train-pipe has been shut.

In the signal-pipe B is arranged a three-way cock K, containing the three-way plug K', carrying on the upper end of its valve-stem K^2 a handle L, standing in the same direction as the handle D, previously mentioned and shown in Fig. 1. A segmental gear L' is formed on the handle L and is in mesh with a segmental gear secured to the upper end of the stem O^2 of a two-way plug O', mounted to turn in the auxiliary cock O, preferably cast on the signal-pipe cock K. One end of this auxiliary cock O is connected with a pipe P, containing an ordinary valve Q and opening to the whistle or other alarm I below the pipe H'. (See Fig. 2.) The other end of the auxiliary cock O is connected by a pipe R with the train-pipe B on that side of the valve K opposite to the side on which the pipe J enters the signal-pipe B. The plugs K' and O' are so arranged relative to each other that when the plug K' is open, as shown in Fig 3, the plug O' is shut off—that is, it disconnects the pipes R and P; but when the handle L is turned in the direction of the arrow a' then the plug K' closes one end of the signal-pipe B and connects the other end with the pipe H. (See Fig. 5.) At the same time the plug O' is moved into an open position to connect the pipes R and P with each other.

Fig. 1.



Now it will be seen that while the signal-pipe cock K is in an open position, as shown in Fig. 3, the auxiliary cock O is closed, and consequently no air can pass to the whistle or alarm I; but when the handle L is moved to the right, then the plugs K' and O' move simultaneously into the position shown in Fig. 5—that is, the plug O' moves into an open position to connect the pipes R and P with each other and the other plug K' connects one end of the signal-pipe with the pipe H, previously mentioned. When this takes place and the air passes to the signal-pipe B in the direction of the arrow b', then air will pass from the signal-pipe through the pipe R, the auxiliary cock O, pipe P, to the alarm I, so as to sound the same, thus notifying the engineer and conductor that the cock for the signal-pipe B has been closed.

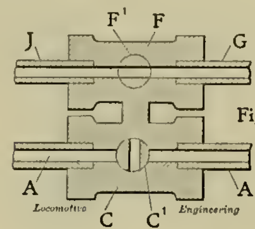
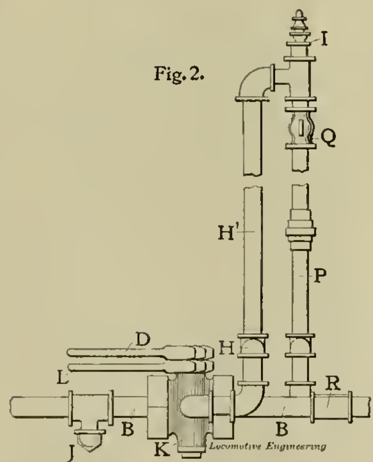


Fig. 4

Fig. 2.



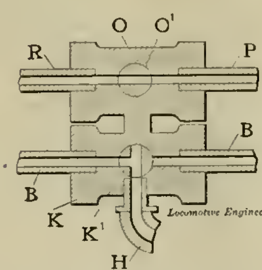


Fig. 5

If the air passes in the inverse direction of the arrow b' through the signal-pipe B, then the air passes through the three-way cock K' to the pipe H (see Fig. 5), and from the latter to the branch pipe H' to the alarm I, so as to sound the same. Thus, no matter which way the air passes to the signal-pipe, the alarm will be sounded whenever the cock in the pipe is closed.

The rear end of the last car in the train has the valve Q closed, so that an alarm is not sounded when the handles D and L are moved into such positions as to close the valves C and K.

I might add that the whistle is locked up in the car, and nobody but the brakeman can get at it.

ADAM MCINTOSH.

Albany, N. Y.

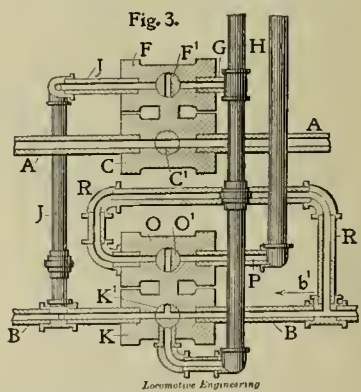
Device for Easing Rotary Valve Movement.

Editors:

I noticed in answer to question No. 98, October issue, in reference to hard-working brake valves, you recommended oiling the gasket between the key collar and top cap of engineer's brake valve in order to overcome the trouble complained of.

The gasket mentioned becoming dry, is undoubtedly the cause of many brake valves working hard, and particularly so where a high main reservoir pressure is carried. Frequently in taking the valve apart, the washer will be found quite dry, while the rotary valve and its seat will be in a fair state of lubrication. This is to be expected, when we take into consideration the unbalanced area of the key, together with the material used to pack against leakage at that point. Upon turning to Haswell, under the head of Experiments in Friction, it will be noticed that tanned ox-hide upon cast iron, greased, gave a higher coefficient of friction than any of the other thirty-seven materials experimented on. Several air-brake men have adopted the plan of using a white-metal ring for packing at that point, with very satisfactory results.

Fig. 3.



Engineers who pride themselves on their ability to stop an air-braked train at the point desired without shock or lurch, tell us that a nice working brake valve contributes largely to that end, and many of them clean and oil the valve under their charge. The superiority of the 1892 (E-6) brake valve over the 1890 (D-8) for all classes of service goes without saying; however, one feature of the latter that found favor with enginemen was the small amount of trouble required to take out the rotary valve and key for oiling and cleaning.

Some time ago, while thinking of this subject, the plan of oiling the key gasket, as shown by the accompanying sketch, suggested itself, and it appears to answer the purpose very well. The supply of lubricant (tallow) is held in the central hole of the key stem, and by advancing the threaded plug one turn, a small amount of the lubricant is forced out of each radial hole onto the gasket. This, of course, is done before the pump has been started and pressure accumulated. The device is hidden from view, and it is not believed that the reduction in section of the stem weakens it to any appreciable extent.

C. P. CASS,
St. L. & S. F. R. R.
Springfield, Mo.

QUESTIONS AND ANSWERS
On Air Brake Subjects.

(131) T. E. F., Bergen, N. J., asks:

What are the advantages claimed for the new air signal reducing valve over the old one? A.—The supply passages are larger, and the operating parts are larger, stronger and more accurate in their working.

(132) J. F., North Bay, Ontario, asks:

What is the object of having the stem of piston 47 in engineer's valve extend below the seat to train line exhaust? A.—To limit and more gradually control the exhaust of pressure from the train pipe when the equalizing piston rises.

(133) R. B. M., Buffalo, N. Y., asks:

You claim that keeping all brakes cut-in keeps them in good working order. Please explain. A.—An air brake is like a watch: it is kept in good condition by working instead of lying idle, rusting up, and not able to work when you want it to.

(134) R. Q., Marshalltown, Ia., asks:

1. What should be the correct diameter of the hole in reversing valve chamber cap? A.—1. See article on "Air Pump Repairs," this department, this number. 2. On measuring the length of the stop pin for main valve in the air pump, should it measure 25-64 in. from top of gasket or with gasket removed? A.—2. With gasket removed. See cut and measurements on page 518, November number.

(135) P. L., Pittsburg, Kan., writes:

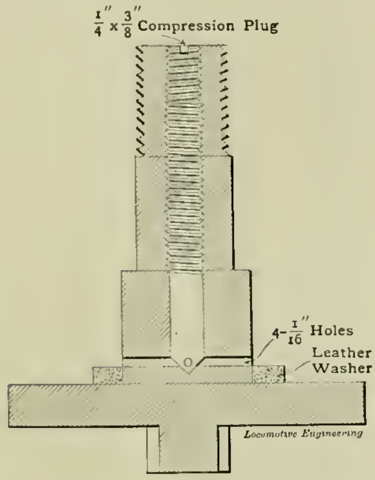
In the answer to Question 283 Progressive Questions and Answers by the Air-Brake Men, it says to see 1895 proceedings for further information. I am unable to get that book. Can you help me? A.—The book is out of print now, and we don't know where you could get a copy. The reference made in Question 283 is to a lengthy and complete report on slid flat wheels made at the St. Louis convention.

(136) R. Q., Marshalltown, Ia., asks:

What is the most wear allowable on a reversing valve stem before renewing? A.—There is no accepted limit, but there should be no considerable play in the parts. For a good working pump, the stem, and ofttimes the bush and cap nut, should be renewed when the pump is overhauled. Frequently, however, the stem is renewed, but the worn cap nut and bush do not tightly fit the new stem, and the job is then only half done. The parts should have a neat sliding fit.

(137) R. Q., Marshalltown, Ia., asks:

How do you test the graduating spring 9 in the plain triple valve? A.—This



WASHER LUBRICATING DEVICE.

test is not of any great importance, although it should be given its share. A repairman soon becomes familiar with the resistance offered by the spring and can tell approximately by pressing it with his thumb whether it has sufficient tension. However, should you wish to carry the test further, the device illustrated on page 144, Air-Brake Men's Proceedings for 1897, would doubtless meet your requirements.

(138) R. Q., Marshalltown, Ia., writes:

In renewing the upper air valve bushings for the 8-inch pump, I find them all too loose. What is the best way to make a tight fit? All bushings are factory made. A.—In fitting the bush in great care should be taken to make the two shoulders on the brass bush, the bottom of the cap nut on the bush, and the collar of the cap nut on the cast iron all seat at once. Fit the two shoulders, even scraping and grinding them in first, then carefully fit the cap nut with red lead and scraper. Be careful and don't crush the bush by a careless fit of the nut.

(139) R. B. M., Buffalo, N. Y., writes:

In one of your numbers which gave illustration of the Shaw slack adjuster, it was claimed that the dead lever was the only right place to take up slack. Is this true? A.—The dead lever is no doubt the better place to take up slack on an air-brake car which has no adjuster, but it is an open question on cars having slack adjusters. There are slack adjusters in actual operation, and giving splendid satisfaction, which take up slack elsewhere in the rigging than the dead lever. The McKee is a good example, which takes up slack at the cylinder lever.

(140) E. O. P., St. Albans, Vt., writes:

When a reduction of train pipe pressure of 15 pounds is made, a like reduction of auxiliary reservoir pressure is made. Why is it that a gage attached to brake cylinder will show a pressure of about 25 pounds? A.—The capacity of the brake cylinder when compared to that of the auxiliary reservoir is such that when 15 pounds of the auxiliary reservoir pressure expands into the brake cylinder it amounts to 25 pounds in the cylinder. In other words, the brake cylinder is smaller than the auxiliary reservoir, and 15 pounds from the auxiliary will make 25 in the cylinder.

(141) R. L. B., Port Jervis, N. J., writes:

Suppose the air brake is set full on a passenger car, and the brakeman takes hold of the hand brake wheel and applies force, but cannot move the wheel any. Does the force he puts in trying to turn the wheel go to set the brake tighter? A.—No. There will be no more brake power put on the shoes until the brakeman succeeds in turning the wheel some. If the dog happened to be in the ratchet wheel, the stress on it would be lessened the amount the brakeman pulled on the brake wheel, but that is all the effect that would result.

(142) R. H. N., Trenton, N. J., writes:

In looking over past numbers I find a statement in the August, 1896, number, question 53, saying the equalizing piston in the engineer's valve does not lift full distance till on about a thirty-car train. In the December number, 1897, question 134, it is stated it goes its full lift with ten cars. Which is correct? A.—These two cases were used to illustrate the difference in the lift of the piston on one car and on a large number of cars. In fact, it is not known just how the piston does lift with trains of different length, and no lift can be assigned as a standard, as it will vary with the condition of the piston. A tight working or dirty piston would be erratic, while an easy working piston might lift uniformly.

(143) R. Q., Marshalltown, Ia., asks:

How can you distinguish a blow caused by the reversing slide valve rod wearing loose in the cap nut from other blows? A.—A blow thus caused is had on the up stroke only, and cannot be distinguished from blows caused by loose reversing rod in bottom of reversing slide valve bush, loose bush, worn rings in reversing piston, loose reversing piston stem, loose reversing piston bush or leaky reversing slide valve, as blows caused by all of these faults will leak steam into the top end of main cylinder only. However, if the condition of all these parts is known, the blow can be traced to the faulty part. A blow, therefore, which manifests itself only on the up stroke must be one of these parts; while for a blow which is had on both up and down stroke, we must look further to the packing rings in the main valve and the main piston.

(144) G. R., New York, writes:

1. Why does a shoe 18 inches long give no greater holding power if bearing on only half its surface than on whole? 2. Why won't one 18 inches long hold better than one only 9 inches long? A.—The Master Car Builders' Committee, appointed to make brake shoe tests, found that the ends of a shoe 18 inches long would stand away from the wheel tread after an application which caused the generation of a considerable amount of heat, and permitted only a certain portion of the shoe near the middle to do effective work. The shoe ends standing off was due to the straightening out influence imparted to the shoe by the heat. If the shoe were made only 3 or 4 inches in length, the friction per square inch would be so great that the heat generated would cause the metal to melt and run, and little holding power would be had. It was necessary, therefore, to find a medium length of brake shoe which should remove as far as possible these two evils, and 9 inches was found to be a good compromise. A new brake shoe, having a small partial bearing on the wheel has the same tendency to melt and run until the whole bearing is had. This, with the poor friction offered by the scale or film on a new shoe, gives poor braking or holding power.

An Old Iron Coach.

An esteemed correspondent who has been for years a friend of the railroad department of the *Post* sends the following interesting history of an ancient car:

"The old relic used on the Sharpsville railroad for the transportation of passengers, called 'the coach,' still has an existence and affords a theme for many a drummer's joke. They call it 'the coach' because it is the only car used by passengers on the line which extends from New Wilmington Junction on the Western New York & Pennsylvania to Sharpsville on the Erie & Pittsburg and the Erie Railroad. It is declared that in the whole world there is no other car like this, and is still serviceable, although hoary with antiquity.

"It is said to be the pride and joy of Receiver McIlvaine's heart, and the fond look that bespreads itself over his benign countenance when he gazes on the embossed sides of 'the coach' would remind one of the appearance of a young father handling his first 'kid.'

"This coach has an interesting retrospective history, unique in the annals of transportation in this country, and should have been exhibited at the Pittsburg Exposition long before this alongside of the magnificent Pullman car, as the contrast would be a grand object lesson in coach building.

"This old coach was built at New Brighton in 1862 or 1863, and was one of a lot of twenty-four built for the old Pittsburg, Ft. Wayne & Chicago Company by a company organized for the purpose of building iron cars. The patentee and promoter of the scheme was George Glass, who was at that time a master mechanic on one of the railroads entering Pittsburg. He succeeded in enlisting capital enough to build a manufacturing plant and put in the necessary machinery to build cars. Their first, and I think their last, order for coaches was for the twenty-four cars for the Pittsburg, Ft. Wayne & Chicago, which were put in service but were quickly condemned by the traveling public, as they were too hot in summer and too cold in winter. They were next assigned to the emigrant traffic, where they remained for about one year, when they were distributed among the local freight crews as cabin cars. One of them, 'The Coach,' was sold to a farmer who was at that time a stockholder in the New Castle & Franklin Railroad, afterward the Oil City & Chicago, the Pittsburg, Titusville & Buffalo; the Buffalo, New York & Philadelphia, and finally the Western New York & Pennsylvania. The farmer, as above stated, sold it to the New Castle & Franklin, where it was used for some time, when he obtained possession of it again through some legal process and rented it to the late General James Pierce, who was then president of the old Sharpsville & Oakland Railroad.

"How the Sharpsville Railroad Company obtained a title 'deponent sayeth not,' but from that date until the present day 'the coach' has survived the ordinary vicissitudes of railway wear and tear, changes of ownership, etc., and still preserves the even roll of its way between the busy little town of Sharpsville and the classic precincts of Wilmington, under the pilotage of Captain Frank Locke as conductor and 'Billy' Deeter, engineer, and it promises to be still running when some of the other railroad relics have departed to the shades."

As a fitting sequel to the above interesting narrative, the railroad editor would call attention to the fact that the story proves that what the ancient philosopher said about there being "nothing new under the sun" was very near correct, and consequently we may say the pressed-steel car of to-day is only a modification of the iron cars built at New Brighton thirty-seven years ago, and the long life of the old coach is another proof of superiority of the all-steel or all-iron car. It might also be stated that cars with interior metal sheathings are coming into use now and have already demonstrated their superiority. The Schoen Pressed Steel Company is composed of enterprising gentlemen, and we have no doubt that they will send one of their expert mechanics to make a report on the old car of the Sharpsville Railroad and the principles of its construction, which they will have printed in the *Post* and other recognized railway journals.—*Pittsburg Post.*

Some Railroad Facts of 1898.

Mr. Duane Doty, of the Pullman Palace Car Company, has compiled some interesting figures on railroads in this country.

In the matter of mileage, Illinois leads the other States, while the total mileage has increased from 22 miles in 1830 to 186,500 in 1898, and counting sidings and turnouts, this reaches 244,500 miles. This is owned by about 2,000 corporations. Freight rates average one-eighth of a cent per ton per mile.

His figures give the people employed as 850,000, with an average pay of $565 per year. Taking out the higher salaries, this leaves pretty slim picking for some of them.

There are 37 cars to every locomotive (not counting sleepers) or a total (without sleepers again) of 1,325,000 cars.

When we are wondering about the demand for new cars, it is well to remember that about 100,000 are scrapped every year, so this number is required to keep up the supply, to say nothing of an increase.

There are 36,000 locomotives in use, 10,000 of these being in passenger service. Each of the latter haul on an average of 50,000 passengers per year. Freight engines pull 30,000 tons of freight in the same time Their work is equivalent to carrying one ton 1,300 miles for every man, woman and child of the population. Freight gives over three-fourths of the receipts from the roads.

The Atchison, Topeka & Santa Fé have lately been extending their system of block signaling, with very satisfactory results. An official of the company, speaking of this improvement, said that the saving in expense formerly resulting from train collisions would soon pay for an elaborate block system. Owing to the great length of the blocks, freight trains are handled on the permissive system, but passenger trains have the absolute block.

The Tabor Manufacturing Company, Elizabeth, N. J., send us a pamphlet describing their molding machine and giving considerable information as to its working. The pneumatic vibrator which they use is one of the neatest devices in the field of molding machines, and the whole machine has many interesting points. Those who have foundries or foundry work should send for a pamphlet.

WHAT YOU WANT TO KNOW.

Questions and Answers.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(87) L. E. K., Baraboo, Wis., writes:

Authorities on valve motion say that the angularity of the eccentric rod tends to distort the movement of the valve. I cannot see how this can occur with such a small crank arm or throw. Is it of sufficient magnitude to seriously affect the motion? A.—No, the angularity of an eccentric rod is of very little importance in its bearing on the movement of the valve.

(88) J. P. K., Buffalo, N. Y., writes:

Can you burn the smoke-box end of a flue in a locomotive boiler while going up grade, provided the water gets low enough to expose it, although back on the crown sheet there is plenty of water to protect it and the firebox end of flues? My friend claims that it can be done; I say it cannot. Which is right? A.—Under certain circumstances the tube end might get burned, but it is not likely to happen, unless there is a very small part of the flue covered with water.

(89) J. F., North Bay, Ontario, Can., asks:

At what temperature does the water from an injector enter the boiler? A.—This depends on the temperature of feed, the steam pressure and on the kind of injector. A fixed nozzle or single set of tubes will not heat it as high as a double tube injector. The former will range from 120 to 150 degrees, while the latter may go as high as 200 degrees. Some makers have claimed higher than this, but it is exceptional.

(90) F. U. N., Haverhill, Mass., writes:

I recently saw some front cylinder heads ground on, which struck me as being a laborious way to make a joint on a locomotive cylinder. Is this common practice? A.—It is an unusual thing to make a joint on front cylinder heads by grinding, although it is done to some extent on back heads. The best and cheapest joint for one as likely to be broken as the front head, is the soft copper wire, 3-16 inch diameter, let into a groove on the joint of the head. This practice is nearly universal.

(91) G. A. S., Galveston, Texas, asks:

1. Does not the clattering of solid side rods indicate too much lost motion on the pins? A.—1. Not necessarily, for the reason that side rods require to be fitted loosely when new, in order to be free from binding during vertical oscillations and curving of the engine. 2. What would be the proper amount of play to give a rod bushing on the pin when first fitted? A.—2. There is a variation of practice in this respect, the diameter of bush being made from a full 64th to a full 32d inch larger than the pin, and also given a lateral motion of about 1-64th inch. It is the movement laterally on the pin that causes the disturbance you mention, rather than the diametral fit.

(92) K. O. D., Buffalo, N. Y., writes:

I notice a great difference in the diameter and hight of smoke-stacks on several roads and also on the same road, for cylinders 18 inches in diameter. Can you say why this condition of things should obtain at this time when all details of locomotive design are supposed to be governed by well defined requirements? A.—There appears to be no standard hight or diameter of stack for a given size of cylinder; indeed, the necessity for such a standard has never yet forced itself on locomotive men for the reason that a very wide range of dimensions are allowable without impairing the steaming efficiency of an engine. We have known of stacks for this diameter of cylinder to vary from 18 inches to 14 inches, and all do equally well.

(93) R. A. W., Stockton, Cal., writes:

Please inform me through your paper: 1. To what, if anything besides centrifugal motion, do you attribute the greater wear on the smaller side of eccentrics? A.—1. It can be shown that centrifugal force is responsible for the wear on the small side of eccentrics; but it does not follow that the wear is greatest at that point. The work done to overcome the inertia and frictional resistance of the valve motion causes excessive wear on the side of eccentric next to the shaft, and this is greater in many cases than the wear due to centrifugal action. 2. Some eight-wheel engines have dust collars on the journals of the back drivers. Have these collars any other uses except to exclude dust? A.—2. These collars have no other function that we know of, than to act as dust guards, and they do this admirably on the Union Pacific, where they have been in use for some time

(94) M. E. R., Meadville, Pa., writes:

Will you please say how the heat radiated from incandescent coal may be determined? A.—The formula given in D. K. Clark's Pocket Book is extensively used to calculate the heat radiated from incandescent coal or coke, as follows: When

$R =$ quantity of heat radiated per square foot of surface per hour in British units;

$\theta =$ temperature of the enclosure in Fahrenheit degrees;

$t =$ excess temperature of surface of hot body above the temperature of the enclosure, θ, in Fahrenheit degrees.

$a =$ constant, 1.004.

$$R = 144\, a^{\theta} (a^{t} - 1)$$

By the formula the increase in the rate of radiation is in a higher ratio than the excess temperature, when the temperature of the enclosure is constant. The heat radiated from a coal or coke fire is estimated at about one-half of all the heat generated.

EQUIPMENT NOTES.

One engine for the Almapee & Western is under way at Baldwin's.

Two engines are under way for the Leopoldina Railway at Baldwin's.

Harlan & Hollingsworth are building fifteen passenger cars for a railroad in Corea.

Wells and French are building 500 freight cars for the Continental Fruit Express.

The Lorain Steel Company are having forty steel cars built by the Schoen Car Company.

One engine for the Ferro Carril Xico & S. R. is being built at the Baldwin Locomotive Works.

The Flint & Pere Marquette are having five passenger engines built at the Brooks Locomotive Works.

Two passenger cars are being built for the Chesapeake Beach Railway at the St. Charles Car Works.

Jackson & Sharp are building fifteen passenger cars for the Washington County Railroad of Maine.

Five freight engines are being built for the Boston & Albany at the Schenectady Locomotive Works.

The Baldwin Locomotive Works are engaged on one engine for the Esquimault & Nanaimo Railway.

The Riddle Coach & Hearse Company are having two cars built by the Youngstown Car Company.

The Indiana Car & Foundry Company are building two cars for the Mather Stock Car Company.

Six passenger engines are being built at Schenectady for the Chicago, St. Paul, Minneapolis & Omaha.

The Chicago, Burlington & Quincy are having 300 freight cars built by the Wells & French Car Company.

The Pullman Palace Car Company are building two passenger cars for the Chicago, Rock Island & Pacific.

Two engines are under construction at the Baldwin Locomotive Works for the Choctaw, Oklahoma & Gulf.

The Atchison, Topeka & Santa Fé are having five passenger engines built at the Dickson Locomotive Works.

Two freight engines are under construction for the Buffalo, Rochester & Pittsburg at the Brooks Locomotive Works.

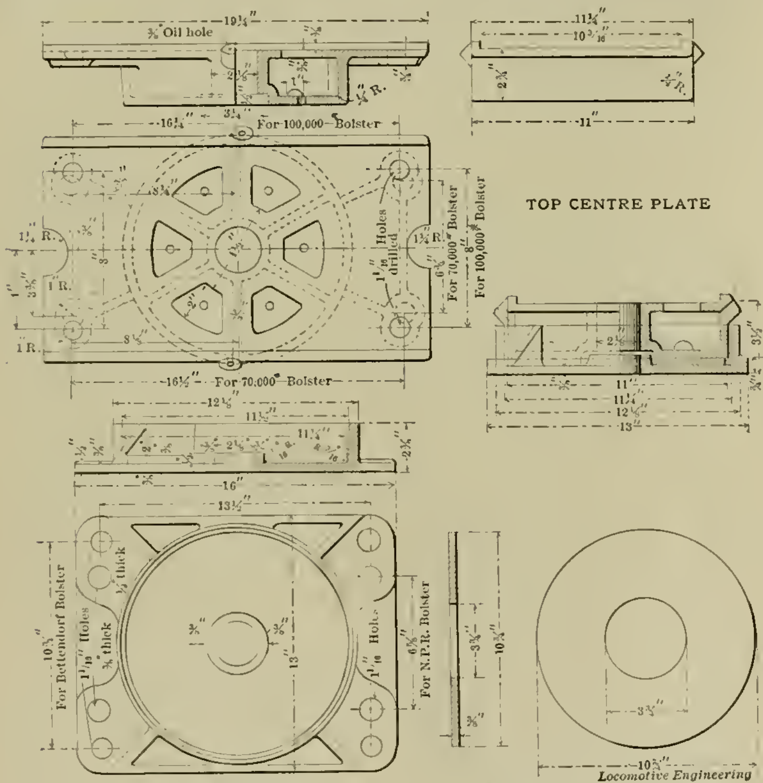
Two six-wheel connected engines for the New York Central are under construction at the Schenectady Locomotive Works.

The Burlington, Cedar Rapids & Northern have ordered six first-class coaches, three from the Pullman Company and three from Barney & Smith. They will be 75 feet long, have the standard steel platform, Scarritt seats, and finished in quarter oak. They will have four-wheel trucks with 60,000-pound axles.

A Lubricated Center Plate.

The resistance of cars on curves, due to the bolsters deflecting sufficiently to allow the side bearings to be in contact, has been a two-edged sword which cut in the way of reduced haulage, and also thin flanges, if we may accept the diagnosis of the doctors. It has come to be understood, too, that there is quite enough frictional resistance in a pair of rough, dry center plates to prevent a car truck from easily taking its correct position on a curve. In such a case the results must be exactly the same as those cited above.

In order to overcome such a contingency, the center plates shown herewith were devised on the Northern Pacific.



TOP CENTRE PLATE

Bottom Centre Plate

Steel Liner for Centre Plate

LUBRICATED CENTER PLATE.

They are made of malleable iron, and of such a shape that oil, when poured into apertures provided for it in the upper plate, will find its way to the lower one and be retained there to reduce the friction of the surfaces in contact. There is a steel plate liner, as shown in detail, which is placed between the bearing faces of the plates, thus distributing the wear over four surfaces, and without doubt increasing the life of the plates. These plates were designed for cars of 100,000 pounds capacity; but their use on lighter cars has been found highly satisfactory, notably on the Lake Erie & Western, where Superintendent of Motive Power Reilly is using a lubricated design of his own, and who says that he does not have a sharp flange on his wheels—a situation traceable directly to his center plates. The next thing in order now will be a ball-bearing center plate, if reduction of friction is what is required. We are enabled to present these new plates by courtesy of Mechanical Engineer Thompson.

Favors a Standard Car Coupler Knuckle

There is no railroad official better informed than Mr. Peter H. Peck regarding the weak points of a car that by failure leads to annoying and expensive delays. Mr. Peck is master mechanic of a railroad which is in reality a huge switching yard. With the knowledge of car defects that comes from his peculiar experience, Mr. Peck has been moved to raise his voice in favor of a standard knuckle for the M. C. B. coupler. In connection with his advocacy of reform in this direction, which was expressed in a paper read at the Western Railroad Club, Mr. Peck submitted figures about the great variety of knuckles in use that will surprise people who have not watched details of the increasing diversity of coupler knuckles.

When the M. C. B. coupler was first adopted, and during the discussions that preceded its adoption, the argument was frequently made that the adoption of the vertical plane type would put an end to the inconvenience in repairing foreign cars that resulted from the diversity of link and pin couplers. How far this hope has failed of being realized may be judged from the figures submitted by Mr. Peck, who had been able to find a total of seventy-seven M. C. B. couplers and ninety-three knuckles, nine bars having two and two bars three knuckles each. Only one instance was found of the knuckles interchanging with each other. The yards where Mr. Peck's locomotives work, for convenience and expedition in repairs, ought to carry spare knuckles for all the M. C. B. car couplers in use. In investigating what it would cost to keep in stock one knuckle of each kind, Mr. Peck discovered that the average weight was 48 pounds. It would require 4,464 pounds of metal, at an estimated cost of $156.24. To furnish one knuckle for each drawbar at sixteen points on his system would call for the expenditure of $5,624.64.

The case has become serious enough to demand a remedy, and that applied quickly, for every month's delay increases the evil. We hope that Mr. Peck will persist in his attacks upon this growing source of useless expense, and that his labors will lead the railroads out of the wilderness of confusion they have fallen into.

Cleaning Crown Bars.

At the Chicago shops of the Chicago & Northwestern they clean the scale from crown bars by bringing them to a red heat and cooling quickly in a tank of cold water; the sudden change of temperature causing the scale to fly from the iron, and leaving it perfectly clean. We have known this plan of removing scale to be successfully used on flues, where the need for a clean surface is imperative, which cannot be the case with a crown bar, except for a radically different reason—that of knowing the physical condition of the bar, which information is impossible to reach while the bar is covered with scale.

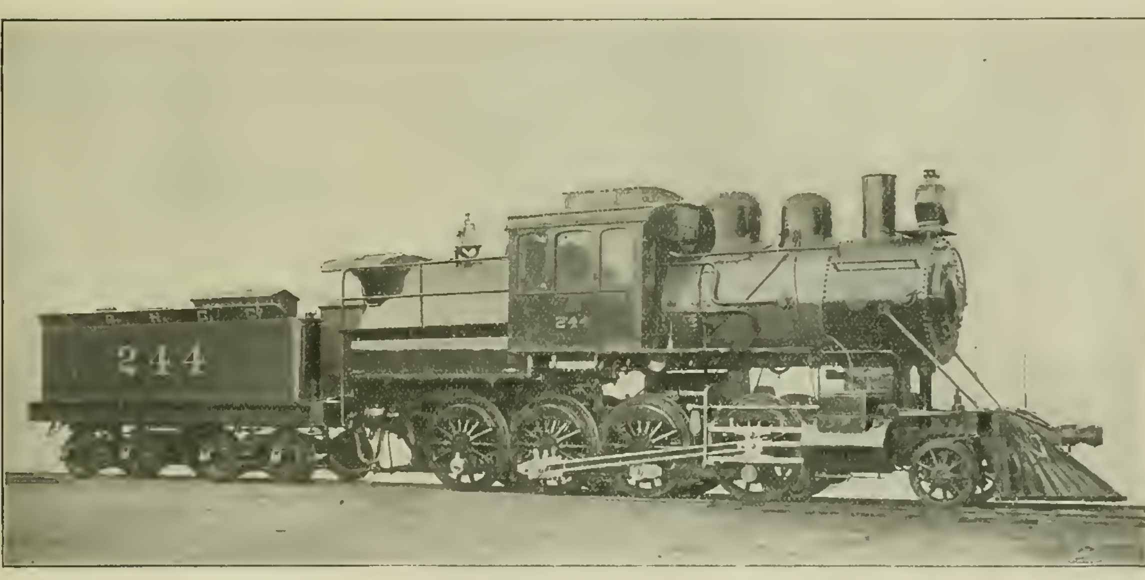
One of our English contemporaries, in commenting on the special train of seventeen Pullmans from Chicago to Omaha, calls attention to the coal consumption, which it considers enormous. This was said to be 90 pounds per engine per mile, and is said to be over 50 per cent. heavier than the consumption of the Northwestern compounds, weight for weight of train. The evaporation is about 5 pounds per pound of coal.

"Steel Making" is the title of a very handsomely and artistically illustrated catalog issued by the Crescent Steel Company, Pittsburg, Pa. It contains beautiful engravings showing a great variety of processes in steel making and interesting facts about steel that nearly every mechanic will obtain information from. Both engravings and printings are done in the very highest line of the arts. Send for it if you are interested.

Delaware & Hudson Canal Company Locomotive.

The consolidation locomotive shown is one of a group recently built by the Dickson Locomotive Works for the Delaware & Hudson Canal Company. As will be seen in the engraving, the engine has a Wootten firebox and is designed to burn slack coal.

The cylinders are 20 x 26 inches, and driving wheels are 56 inches diameter, with steel centers. The main journals are 8 x 10 inches. The boiler carries steam pressure of 180 pounds to the square inch, which, with the cylinder and wheel dimensions noted, gives a tractive power of 28,414 pounds. The diameter of the boiler is 61 inches, and contains 255 2-inch tubes, 13 feet long. The firebox is 10 feet long by 8 feet wide. It provides 173.4 square feet of heating surface. The tubes provide 1,735.7 square feet, making a total heating surface of 1,909.1 square feet. The grate area is 80 square feet. The boiler is covered with magnesia lagging.



DICKSON TEN-WHEELER FOR DELAWARE & HUDSON CANAL COMPANY.

PERSONAL.

Mr. Otto Burgert has been appointed foreman of the Vandalia shops at East St. Louis, Ill.

Mr. P. J. Flynn has been appointed assistant train master of the Buffalo division of the Lehigh Valley at Sayre, Pa.

Mr. George M. Jarvis has been appointed district superintendent of the Intercolonial Railway at Moncton, N. B.

Mr. Edward T. Worman has been appointed general foreman of the shops of the Louisville, Evansville & St. Louis at Princeton, Ind.

Mr. T. D. Rhodes has been appointed superintendent of the Northern Alabama Railroad at Sheffield, Ala., vice Mr. N. R. Adriance, resigned.

Mr. John Medway has been appointed master car builder of the Swift Company, with headquarters at the Union Stock Yards, Chicago, Ill.

Mr. W. D. Cornish, vice-president of the Union Pacific, has been elected president of the Oregon Short Line, succeeding Mr. Samuel Carr.

Mr. Wm. Rennels, district superintendent of the Intercolonial at Campbellton, N. B., has been transferred to Truro, N. S., vice Mr. J. E. Price, promoted.

Mr. F. R. Griffin has been appointed assistant superintendent of the Union Pacific at Omaha, Neb., in place of Mr. H E. Flavin, transferred to Denver, Col.

Mr. A. B. B. Harris, heretofore acting superintendent of the South Atlantic & Ohio, has been appointed general superintendent of that road at Bristol, Tenn.

The office of Mr. John T. Keith, superintendent of the Mahony & Hazleton division of the Lehigh Valley, has been transferred from Delano to Hazleton, Pa.

Mr. L. B. Allen has been made assistant superintendent of the Fergus Falls division of the Great Northern at Melrose, Minn., in place of Mr. W. T. Tyler, promoted.

Mr. J. E. Price has been promoted from district superintendent of the Intercolonial at Truro, N. S., to general superintendent of that road; headquarters at Moncton, N. B.

Mr. Russell Harding, general superintendent of the Great Northern, has been elected vice-president of the St. Louis Southwestern, with headquarters at St. Louis, Mo.

Mr. E. E. Lillee has been appointed assistant superintendent of the Northern division of the Great Northern, vice Mr. W. D. Scott, resigned; headquarters at Grand Forks, N. D.

Mr. F. L. Corwin, trainmaster of the Grand Trunk at Detroit, Mich., has resigned to accept the position of superintendent of the Union Stock Yards at South Omaha, Neb.

Mr. Charles Butler, foreman of the Vandalia shops at East St. Louis, Ill., has resigned to accept the position of master mechanic of the Chicago & Eastern Illinois at Momence, Ill.

At a recent meeting of the board of the St. Louis Southwestern, held in New York, Mr. Edwin Gould, heretofore vice-president, was chosen president, to succeed Mr. S. W. Fordyce.

Mr. T. J. Shellhorn has been appointed master mechanic of the Fort Worth & Rio Grande, taking the place left vacant by resignation of Mr. B. G. Plummer; office at Fort Worth, Texas.

Mr. W. Percy, general car foreman of the Northern Pacific at Brainerd, Minn., has been appointed master car builder of the Wisconsin Central at Stevens Point, Wis., vice Mr. W. Cormack, resigned.

Mr. D. H. Nichols, superintendent of the Pecos Valley & Northeastern, has been promoted to the position of general manager, vice Mr. E. O. Faulkner, resigned; headquarters at Eddy, N. M.

Mr. C. E. Slayton has been appointed master mechanic of the Chicago Great Western at Dubuque, Ia. He was formerly traveling engineer of the road, and later assistant master mechanic at St. Paul.

Mr. J. M. Davis, superintendent of the Breckenridge division of the Great Northern, has been transferred to the Montana division, with headquarters at Havre, Mont., in place of Mr. L. D. Button, resigned.

Mr. F. E. Ward has resigned as general superintendent of the Montana Central, to accept the position of general superintendent of the Great Northern at St. Paul, Minn., vice Mr. Russell Harding, resigned.

Mr. T. M. Downing, formerly master mechanic of the Columbus, Sandusky & Hocking, has been appointed master mechanic of the Detroit & Lima Northern at Tecumseh, Mich., vice Mr. J. W. Stokes, resigned.

Mr. W. M. Greene, general manager of the Baltimore & Ohio, has resigned to accept the position of vice-president of the Baltimore & Ohio Southwestern, with headquarters at Cincinnati, O., vice W. W. Peabody, resigned.

Mr. J. S. Turner, formerly superintendent of motive power of the West Virginia Central & Pittsburg, has been appointed superintendent of motive power of the Union Pacific, Denver & Gulf at Denver, Colo., succeeding Mr. M. F. Egan.

Mr. Wallace C. Winter, chief clerk to the general superintendent of the Chicago, St. Paul, Minneapolis & Omaha, has been appointed assistant superintendent of the St. Paul & Sioux City division of that road; headquarters at St. James, Minn.

The office of fuel expert, heretofore held by Mr. J. C. Martin on the Southern Pacific, has been discontinued, and Mr. Martin has received the appointment of road foreman of engines, vice Mr. W. H. Russell, assigned to other duties; headquarters at Los Angeles, Cal.

Mr. E. C. Harris has been appointed general superintendent of the Wyoming division of the Union Pacific at Cheyenne, Wyo., succeeding Mr. L. Malloy, resigned. Mr. Harris recently resigned as superintendent of the Fremont, Elkhorn & Missouri Valley at Chadron, Neb.

Mr. Cornelius Shields has been appointed assistant general superintendent of the Western district of the Great Northern at Spokane, Wash., succeeding Mr. F. H. Britton, transferred. Mr. Shields resigned as vice-president of the Spokane Falls & Northern to accept this position.

Mr. Frank A. Harmon has been appointed division superintendent of the Fremont, Elkhorn & Missouri Valley at Chadron, Neb., succeeding Mr. E. C. Harris, resigned. Mr. Harmon has been division freight agent for the last seven years on the same road at Deadwood, S. D.

Mr. H. H. Vaughan, mechanical engineer of the Philadelphia & Reading Railroad, and previously mechanical engineer of the Great Northern Railway, has accepted the position of mechanical engineer of the Q & C Company. His headquarters will be at their Chicago office, Western Union Building.

Mr. S. D. Hutchins, who has been in charge of the Westinghouse air-brake instruction car for the past few years, has been appointed to the position left vacant by the death of J. W. Shannon, the Westinghouse representative at Buffalo, N. Y. Mr. Hutchins is succeeded by Mr. I. H. Brown, of the Chesapeake & Ohio Railway.

The friends of Moses Boyd, who had been a conductor on the N. Y., N. H. & H. for over fifty years, celebrated his eighty-fifth birthday at Dedham, Mass., a month ago. The "oldest conductor" is about as plenty as "Washington's old nurse," but 1843 was Boyd's entry with the B. & P. R. R. An "old commuter" of 1844 still makes frequent trips to Boston from Dedham, Mass.

Mr. H. Tandy, who has been so long assistant superintendent of the Brooks Locomotive Works, has gone to be superintendent of the Canadian Locomotive Works at Kingston, Ont. Mr. Tandy is one of the ablest shop managers we know of, and we have no doubt that under his supervision the Canadian Locomotive Works will build locomotives as good as anything turned out in this country.

Mr. Samuel M. Vauclain, superintendent of the Baldwin Locomotive Works and designer of the Vauclain compound locomotive, addressed the students of Purdue University, Lafayette, Ind., on Saturday, November 12th. His subject was "Compound Locomotives." Among other things, Mr. Vauclain showed how closely the service tests which he had made on Vauclain compound locomotives agreed with tests made at Purdue.

Mr. W. C. Ennis, for twenty years master mechanic and car builder of the New York, Susquehanna & Western Railroad, has connected himself with the Chicago Pneumatic Tool Company, and will travel from the New York office of that company. Mr. Ennis enjoys a wide acquaintance among the railroad men of this country, and will be a valuable addition to the working force of the Chicago Pneumatic Tool Company. The demand for this company's tools is as active as ever, Boyers pneumatic hammers, riveters and drills being greatly favored by railroad companies.

J. E. W. Keeley.

John E. W. Keeley is dead, at the age of seventy-one, and the motor which was to mote on so many different occasions will probably continue its non-motiveness for some time to come.

Ever since 1873 he has claimed a new power, which was unlimited, of practically no cost, and which would revolutionize mechanics generally. The only revolutions to date, however, are those of his experimental machines; and as it was always a case of "Hands off" for investigators, there is much skepticism as to the motive power.

He continued to work at his motor, securing money from one source and another, and in later years added the "etheric vibration" scheme to his plan, and started his machinery by playing on a violin or jews-harp.

There has been much discussion among learned men as to whether he really had anything or not, but it must be admitted even by his friends that his refusal to let anyone else test the motors, ascertain their power, etc., could not help producing a feeling that trickery played a part.

Indexes for 1898.

Anyone desiring an index for the 1898 volume can have one by sending a request to this office. A postal card with "Please send index.—John Jones, No. 16 Jones street, Jonesville, Conn.," will do the business. Don't be bashful, if you want one.

The air-brake exhaust pipe on Northern Pacific engines passes down through saddle, back of steam chest, into the exhaust passage of cylinder, thus completely avoiding the constant fanning of the fire, which has been no mean source of fuel loss when exhaust was located at the main exhaust nozzles. In addition to this arrangement for saving coal, the pipe is also made pass back to the tender, as a heater ending in a series of coils inside the tank, but with the end of the system outside, so as to avoid carrying oil to the feed water. The exhaust is made to pass in either direction by a suitable cock, which cannot blank the exhaust—it must go either to the saddle or tank. The arrangement is said to be highly successful.

The New York Central people are preparing to put the mechanical department in much closer relation to that of the Lake Shore than it ever was before. The appearance is that a great part of the work on Lake Shore cars and locomotives will be done in the New York Central shops.

A Steel Water Pitcher.

As an example of the beautiful perfection at which the state of the art of pressed steel has attained, the samples of such work as has been turned out by the St. Louis Stamping Company stand an easy first. These pitchers, about 100 of which were made without a failure in the lot, were pressed cold from steel used every day by the American Steel Foundry Company, in the manufacture of their car bolsters, driving wheels, etc.; the ingots being cast by them and rolled into bar form at the Granite City Steel Works, after which they were rolled into sheet form at the Granite Iron Rolling Mills.

The ductility of this metal will be better understood when it is stated that these finished pitchers are less than 1-32 inch thick and without a flaw. They are 4¾ inches diameter at the bottom, 6 inches at the bulge half way up, and 5 inches where contracted just under the spout which is flanged outward with a curve equal to that on the best silver work. They are 9 inches high over all, and as smooth and true as though turned in a lathe. Tubal Cain was said to be a cunning worker in metal. It is not on record, however, that he ever did anything any finer than this. W. S. Calhoun, the general Eastern agent of the American Steel Foundry Company, has some samples of this work at his office, in the Havemeyer Building, in this city. Vases of fabulous price would not appeal to a mechanic half as hard as do these steel pitchers.

A Novel Comparison.

The accompanying illustration showing the shop locomotive of the Pittsburg Locomotive Works and the cylinders and saddle of the large consolidation built for the Union (Carnegie) Railroad, makes about as novel a comparison as we have seen.

The difference in weight of about 50 per cent., counting the small one in working order, gives a splendid idea of the enormous proportions of the large engine. It is more striking than mere figures, or, in fact, seeing a photograph of the engine as a whole.

Curious Tests of Engineering Material.

There are some curious things done by engineers who start out to find the strength and durability of material used for machine purposes. Among the most curious tests we are acquainted with are those required by the British Admiralty and by Lloyds Insurance Company for steel castings. These tests consist in dropping the casting, whatever it may be, from a certain specified hight on to "a hard macadamised road, or floor of equivalent hardness." But little reflection will be needed to show that the result of such a test will be very greatly influenced by the way in which the said casting happens to fall. It will easily be conceived that a very serious stress may be put upon the material, perhaps by dropping on a corner or otherwise falling awkwardly in a direction that the forces would never be applied in when forming part of the engine for which the casting is intended. To be scientifically correct, the only form to which this test would apply with equal fairness in every case is that of the sphere, which, being a perfectly symmetrical figure, would always fall in the same way.

Free Air Brake Instruction.

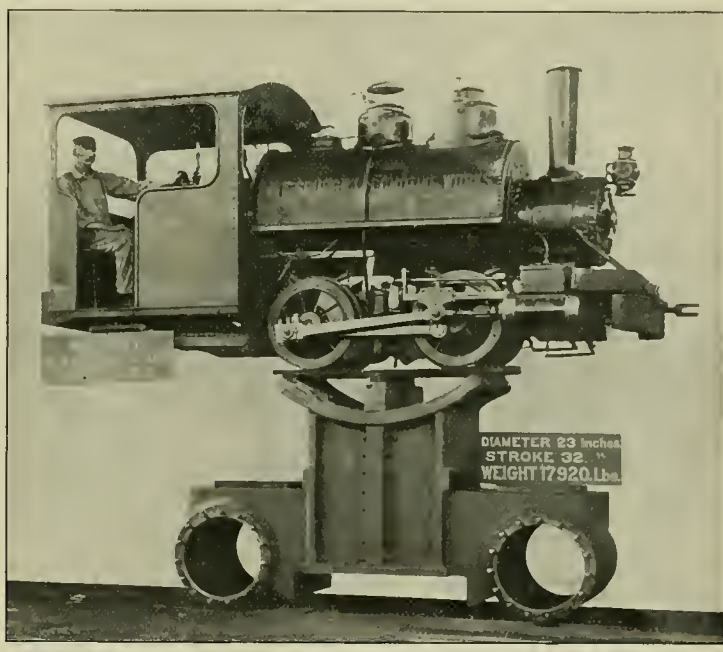
A recent visit to the air-brake car of the American Magazine League—really the instruction car of the Fitchburg Railroad, which we illustrated last month—showed a very complete equipment. Mr. Kelley, the instructor, seems to be very popular with the men, and has made friends in many places. Private letters from Middletown, Buffalo and other places show that he is doing a good work in this line.

This car gives free instruction on the different roads not blessed with instruction cars of their own. It is an advertising plan for the "Standard American Encyclopedia," and does not pose as a philanthropic enterprise; but as the instruction is absolutely free, regardless of the other part, it is being welcomed by the roads. As the books are well worth the price asked, it is a fair deal on both sides, although there is not the slightest obligation to buy the books. The instruction is just the same in any case.

One feature in connection with the payment, which is made monthly, seemed particularly fair. If a man is hurt, sick or out of employment, the payments can be postponed for six months. If he is killed, a receipt in full is sent to his widow. We were shown several acknowledgments of such cases.

The Baltimore & Ohio Railroad is experimenting with an 80,000-pound coal car between Cumberland and Baltimore, where the heavy movement of coal will justify an increase in the capacity of the cars. The present cars now in use have 50 per cent. greater capacity than those used three years ago; but with the changes in the line and the relaying of the track with 85-pound steel and the erection of modern steel bridges, the receivers believe it possible to increase the car capacity to 80,000 pounds. Plans are also being made at the Mount Clare locomotive shops for locomotives to weigh between 225,000 and 230,000 pounds; the cylinders to be 23 x 30 inches, and the rest of the engine in proportion. If this engine is built, it will be used on the heavy grades between Cumberland and Grafton.

The Delaware & Hudson Canal Company are about to abandon their famous gravity railroad at Carbondale, Pa. They are also going to abandon their canal, which for seventy years has been used to transport coal to tide water, and will transport all their coal by rail. It was for this coal route that the first locomotive imported to America was bought.



SADDLE OF CARNEGIE CONSOLIDATION.

Roundhouse Tools at Susquehanna.

In these days of solid rods on locomotives it is conceded to be a good-sized job for one man to handle the ponderous things—and they must be handled bodily in the event a new bushing is needed—for there are no straps to conveniently back off and allow the rod to remain perched on blocks. This has rather revolutionized the old roundhouse appliances for rod work, and the vise as an accessory for closing brasses is out of it as far as the solid rod is concerned. This has made it necessary to introduce roundhouse tools devised to fit the new conditions, and those of the Erie shops at Susquehanna are as near the correct thing as any we have seen.

There are two tools for this purpose, consisting of a pair of 20 x 24-inch air cylinders, with pistons placed tandem, and an air motor geared to a drill spindle. Here is a combination of two simple tools that will either press a bushing in or out of a rod, and drill the oil hole after a new bush is pressed into the rod. Both of these are done near the engine, and the least possible amount of hard work is involved, for the reason that the rod does not have to be wrestled with between the roundhouse and machine shop. There is one of these presses also in the machine shop for use on driving box brasses. The utility of these tools, when placed where they are needed, cannot be overestimated. The presses having double pistons are capable of exerting, with 100 pounds air pressure, a force of 53,400 pounds, or nearly 27 tons, if the frictional resistance of packing is taken at 15 per cent. of the gage pressure. They have been found powerful enough thus far to do all that was expected of them.

The age of a car, like that of the fair sex, is largely a matter of guess. The art preservative of the paint shop will do wonders in each instance, and it is a connoisseur only that can come very close to the mark. A car man must have paid some attention to details of construction to do this, and a close student at that, if he places the number of years that have elapsed since the car went into service. If in possession of the right kind of information, a close guess will be made, just as the geologist can read periods in the age of the earth by the strata formation of its crust. There are many of these old-time cars carrying passengers on branch and suburban lines, which by the hight of belt rail, small windows, inside finish and so on, show a service of twenty years and over.

The Dayton Malleable Iron Company have erected a very large addition to their works. It is fitted up with all the most modern appliances, including electric lighting and power plant.

Intercepting Valve for Compound Locomotives.

The front view of a locomotive in Fig. 1 shows the location of steam passages and intercepting valve with reference to the cylinders, in accordance with the letters patent of John T. Murphy, assignor to the Cooke Locomotive & Machine Company, of Paterson, New Jersey, for an intercepting valve the object of which is to convert an engine from a compound to a simple, and also permit the engine to run simple for any length of time. The intercepting cylinder at *A* is shown with auxiliary exhaust port *B* in communication with the main exhaust passage *C*. This cylinder is fitted with ports *D D*, that open to the receiver D^0, which connects the high-pressure cylinder *F* with the low-pressure cylinder *E*.

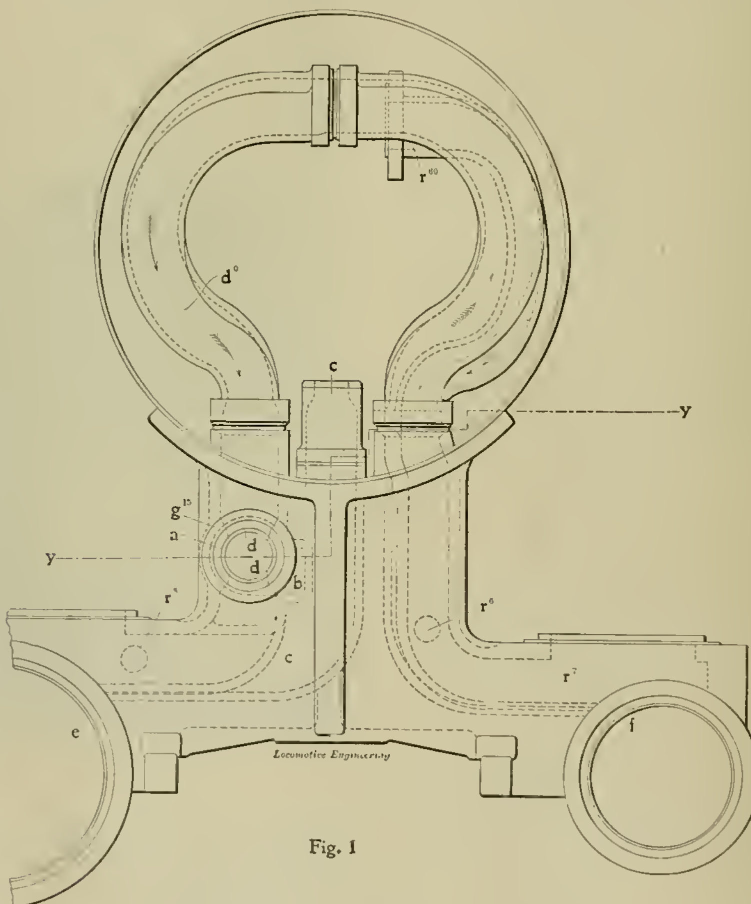


Fig. 1

INTERCEPTING VALVE FOR COOKE COMPOUND.

Fig. 2 is a detail of one of the intercepting valves detached. Fig. 3 is a sectional view on line *X X* of Fig. 2. Fig. 4 is a longitudinal section of the intercepting valve and connecting parts. Fig. 5 is a sectional view on line *Y Y* of Fig. 1. Figs 6, 7 and 8 illustrate, in section, different positions of the intercepting valve at certain stages of operation. In each end of cylinder *A* is a valve case *G*, within which is a piston *H*, having a reduced part H^1 which is arranged to slide in the dash-pot H^2. The piston *H* is secured to the piston rod *I*, on which is secured at the threaded end the bottom M^1 of the valve *M*, the latter being arranged to slide within the inner portion of valve case *G*, and also within the central bore A^1.

The intercepting valve *M* is so arranged within the valve case *G* and the cylinder *A* that when in normal position it closes the port B^1 which connects with the exhaust *B*, and when in working position covers the opening *D*, but has communication with the latter opening by the opening M^2 through the valve *M*, and allows the high-pressure cylinder to exhaust through M^2, *M*, B^1, and auxiliary exhaust *B* into main exhaust *C*.

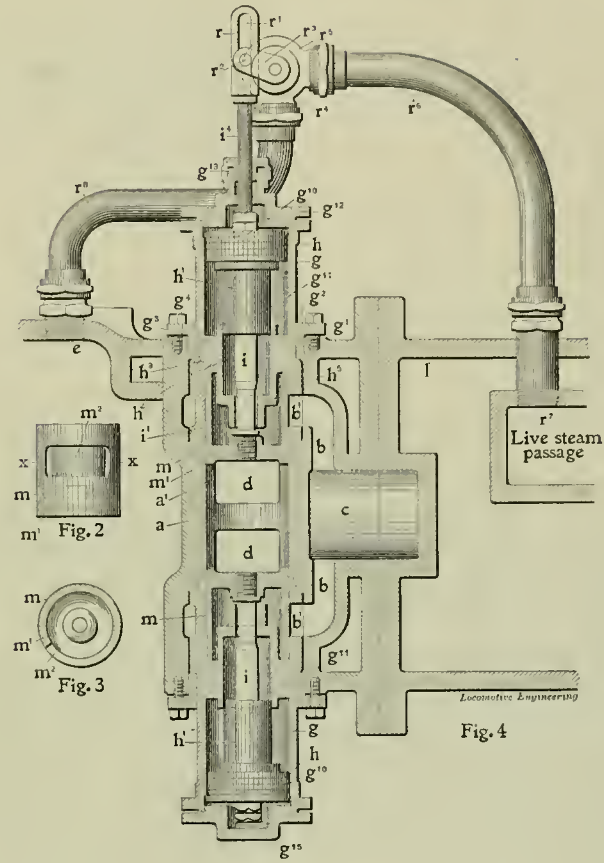
The dash-pot H^2 has a port H^5 that permits air which is compressed during the inward movement of piston *H*, and thus acts as a cushion for the reduced portion H^1, to exhaust into the intercepting valve *M* and through the port B^1 into the passage *B*. The valve case *G* is also fitted with steam ports G^{10} and G^{11} for the admission and exhaust of steam for operating the piston *H*, these ports being connected by pipes G^{30} and G^{31} to the three-way cock, as shown in Fig. 5. The back piston rod *I* is provided with a rod I^1, which has at its outer end a link R having a slot R^1, the slot engaging with the pin R^2 which projects from the end of crank R^3 which is secured to the plug R^4 of admission valve R^5. This valve is connected by pipe R^0 with the live steam passage R^7, and also to the steam passage of the low-pressure cylinder E by the pipe R^8.

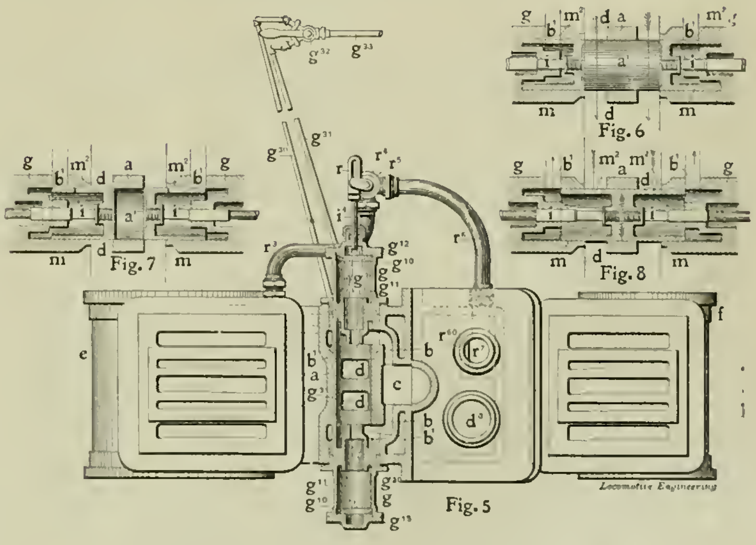
The parts constituting the intercepting valve are illustrated in Figs. 4 and 6 in the position taken when the engine is run as a compound. When the engine is to be started and run first as a simple engine, the three-way cock G^{32} in the cab is operated and the throttle lever opened, permitting steam to enter through the pipe G^{30} and steam port G^{10}, between the pistons H and cylinder heads G^{12} and G^{15}. The pistons H are thus forced inward, and the parts H^1 are cushioned on the air in the dash-pot H^3. The intercepting valves M are pushed inward, covering the ports $D\,D$ in the cylinder A, as in Fig. 7, and upon reaching their innermost positions, opening the ports $B^1\,B^1$, the latter communicating with the auxiliary exhaust $B\,B$, as shown in Fig. 8. Simultaneously the admission valve R^5 is opened, permitting live steam from the passage R^7 to enter through the pipe R^0, and pipe R^8 into the receiver D^0 of the low-pressure cylinder. In this manner the low-pressure cylinder is converted into a high-pressure cylinder, and both cylinders are operative in running the engine simple. The high-pressure cylinder exhausts through the port D, aperture M^2 in the valve M, port B^1, and auxiliary exhaust B into the main exhaust C, while the other cylinder exhausts through exhaust C in the usual way.

After the engine has been run simple the desired length of time, the three-way cock in the cab is again operated, permitting the steam to enter through the steam pipe G^{31} and ports G^{11}, whereby the pistons H are moved outward and returned to their normal positions. The admission valve R^5 is simultaneously closed the same as the ports B^1 and auxiliary exhaust B, while the communication between the high-pressure and low-pressure cylinders is opened through the ports $D\,D$ and receiver D^0, and the engine will then run as a compound.

The Pneumatic Engineering Company, of 100 Broadway, New York, have issued a pamphlet describing the Harris compound direct air pressure pump, which seems to be a new device for this purpose. The interesting feature to railway men is the pumping of water for tanks and similar purposes. The idea is novel, and it will pay the time spent in investigating it, even if only to be posted on the system.

Parrots are being put to a practical use in Germany. They have been introduced into the railway stations and trained to call out the name while the train stands there, thus saving the people the trouble of making inquiries.





INTERCEPTING VALVE FOR COOKE COMPOUND.

Increasing the Capacity of Gondola Cars.

A unique plan for raising the load capacity of coal cars has been put into practice by the inventor, Mr. Jno. Cummerford, the superintendent of the car department of the Lima Locomotive Works. The improvement, as shown in the half-tone, lies in the flanged extension at the top of the superstructure, the flared part being placed at an angle of about 45 degrees with the sides and ends. This causes that portion of the load resting on the flange to have an angle of repose such as will more easily prevent the loss of coal than when heaped on the plain or straight sides, for the reason that the flange is perpendicular to the thrust of the load on it.

The designer believes that it will not be difficult for the practical man to see that this car has the following good points claimed for it: Increased strength in the car; increased capacity; does not take up any more room; saves labor of trimming at loading point; saves loss of coal. Old cars can be converted into this arrangement cheaply by means of a boxed casting applied to any existing stake system. The cars shown have had their capacity increased from 60,000 to 80,000 pounds.

GONDOLA CAR WITH FLARED SIDES.

Improve the Headlight.

We know of no attachment in connection with railroad mechanism that is more in want of improvement than the ordinary headlight. A great many patents got out in the way of improving the headlight have been designed since that kind of a signal was placed upon the locomotive, but one very objectionable feature remains as it was on the primitive headlight, viz., the difficulty of lighting it. Some headlights have openings at the side for a man to push his arm through while starting the light, but it is a poor plan at best, and comparatively few headlights have even that indifferent aid.

Every locomotive engineer who has struggled with the lighting of a headlight on a windy evening will sympathize with those who demand some better means of doing this work. The headlight seems to be fashioned for the purpose of making the lighting of it as difficult as possible, and it seems reflection on the ingenuity of the people who manufacture headlights that they have not found some means whereby it could be lighted without having a tent of coats and other garments held over it on a windy night so that the lighter can get a match to burn long enough to touch the wick.

If there is any one thing more calculated than another to bring the electric headlight into popularity it is the difficulty on windy nights of lighting the common headlight. We had the experience lately of seeing five train men holding protective garments over an engineer while he was trying to light the headlight. The time lost on an important passenger train was twelve minutes.

Over-Cylindering Locomotives.

There is a tendency noted of late to over-cylinder some of the new power and rely on the sand box for adhesion in exerting the maximum tractive effort. The reason for this return to the practice so common only a few years ago, and one harder to evolute out of than any other of the bad things left as a heritage with the old engines is to save the permanent way, undoubtedly. Reducing the load on the rails will do this; but it will, we think, accomplish that end at the expense of tons hauled, in too many cases. In the first place a train hauls hard on sand even on level tangents, and secondly, this situation is aggravated many fold on long hills; while thirdly, there is no other influence equal to sharp sand to destroy tires.

Sand is an absolute necessity at times in starting a train under certain ordinary conditions of the rail, even when the ratio of adhesive weight to tractive power is 4.75; there is, however, so little sand required in this instance that its deleterious effect is not so much in evidence as a drag on the train, or as an abrasive on the tires.

While it is true that a locomotive requires a high adhesion coefficient at starting a heavy train, no matter whether the road is hilly or level, there are places where kinetic energy fails to give the assistance expected, and a resort to sand is just as necessary to get over the "banks" as it is at starting, if there is not a reasonable relation between the weight on drivers and the power required to keep the train moving. These are points that ought to be, and are, well understood at this time, and we do not believe that the rational method of assigning the proper ratios between power and weight will be displaced by the mistakes of the early builders.

During the last year the managers of the Burlington Railroad System have effected a great many improvements, including increase of rolling stock and betterment of the track. The property is now in very fine physical condition throughout its whole length, and is in a condition to run trains making extraordinary fast time.

The Central Railroad Club of Newark, Ohio.

While recently drifting over the Baltimore & Ohio system in pursuit of pertinent points for this paper, we found among other interesting things an association of railroad boys, the objects and purposes of which were of a purely social and fraternal character, and therefore unlike those of railroad clubs in general, which are organized and carried on for the purpose of achieving fame in the discussion of railroad technics.

The club, which has now been in existence three years, has its home in buildings leased from the Baltimore & Ohio Company, and embraces in its membership all railroad employés who care to join, as well as employés of the United States Express Company, Western Union Telegraph Company, and postal clerks on the road. The lease was made to the employés for the sum of one dollar, and around it they have built one of the finest organizations ever comprehended by a club title.

There are two buildings comprised in the lease, one of which contains the club rooms, the other being set apart for gymnasium purposes, lectures and dancing parties. The club house contains a reception room, fitted up in a homelike manner with soft, deep restful lounges and chairs; a reading room, with the best current dailies and periodicals. Among these was Locomotive Engineering, looking by the thumbing it plainly showed, as though it had been "pooled" ever since it struck Newark. A library is just started, which opens out of the reading room, and from the latter the barber shop and bath rooms are reached. On the second floor are situated the billiard room, pool room and card room.

Close at hand is the building referred to as the gymnasium, having a floor space of 40 x 50 feet. This room is fitted up with all appointments going with a first-class place of the kind. A dancing party was on the bills for the evening we were due to leave there, and the waxed floor, with other visible signs of fun to come, nearly caused us to forget our hearthstone far away and indulge in the pleasure of the dance. The club membership numbers 235 at the present time and is growing.

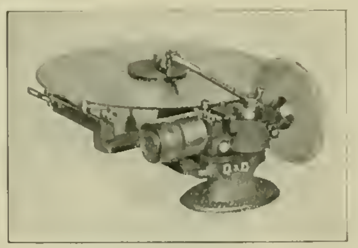
It will not be out of place to say here that there are no strings on this organization, no religion, nor politics. The membership is purely voluntary, with the dues at five dollars a year and paid quarterly by deduction from the payrolls by the company, which makes club collection unnecessary and causes no anxiety about the income to run the club. These dues entitle the member to all the privileges of the club. If there ever was a more genuinely disinterested act performed by a railroad company, that could bring more pleasure to its employés, than this of the Baltimore & Ohio, we have not got it on file. The boys appreciate it.

The following is the present official roster: President, A. E. Crawmer; Vice-President, C. P. Long; Secretary, W. B. Hahn; Treasurer, J. C. Parks. The governing board consists of eight directors, divided into two committees, all of which are employés exclusively, the road not being represented. The officers and board meet once a month. Of all the railroad organizations we know of, or have been connected with, there is the least paternalism in this one, of all. No friction, no debt, and everyone feels as though he owned it.

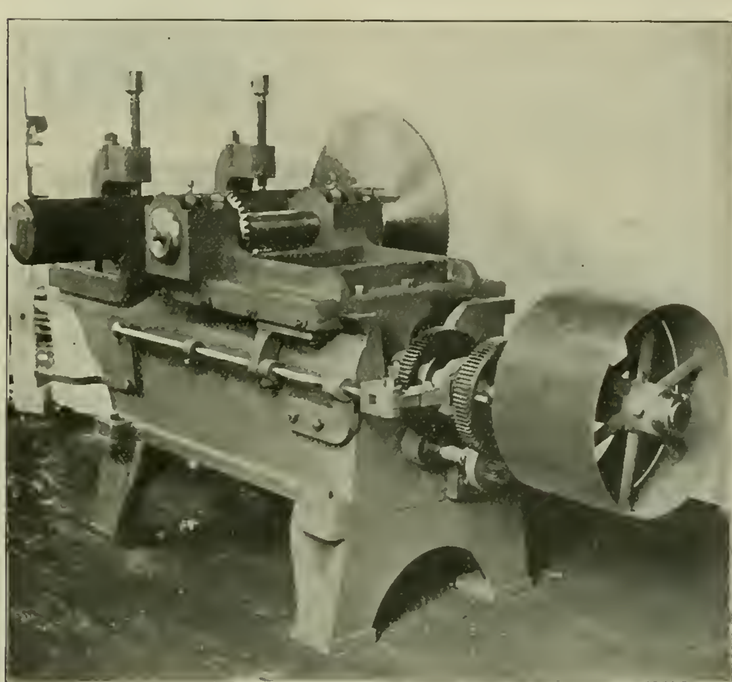
New Power Sawing Machine.

The increasing use of cold sawing machines for heavy work has induced the Q & C Company, of Chicago, Ill., to bring out a new and heavier machine for this work. It is their No. 11, and cuts from 3 to 8 inches round and square stock.

As will be seen, the machine is solidly built and carries a blade 25 inches in diameter by ¼ inch thick, with fine teeth, driven by arbor. The machine weighs about 3,000 pounds, occupies 2½ by 7 feet of floor space, and requires from 2½ to 3½ horse-power, which indicates its power. The saw runs 11 revolutions per minute, cuts 7-16 of an inch per minute, and the saw carriage has a travel of 10 inches. The carriage has automatic quick return after completing cut.



Q & C SAW GRINDER.



No. 11 SAW, OF Q & C COMPANY.

A recent test showed that 160 cuts hardly affected the sharpness of the saw, indicating the life of saw without losing time to grind.

The special automatic grinder shown is furnished at a small price for automatically sharpening the saws when necessary. This will handle any kind of blade used for metal cutting, and is sold separately if desired. Further details may be had from the makers.

Among the latest appliances introduced by the Safety Appliance Company, of Boston, is a comfort appliance intended to prevent water running from the roof of the cars into the necks of passengers when they are going on and coming off cars. It is an improvement that deserves encouragement. Parties interested will find it described in a small booklet which the company has recently published.

Safety hollow staybolts, manufactured by Falls Hollow Staybolt Company, Cuyahoga Falls, O., are specified to be used in the thirty-five locomotives ordered by the Atchison, Topeka & Santa Fé Railway Company. This bolt is steadily gaining in popularity

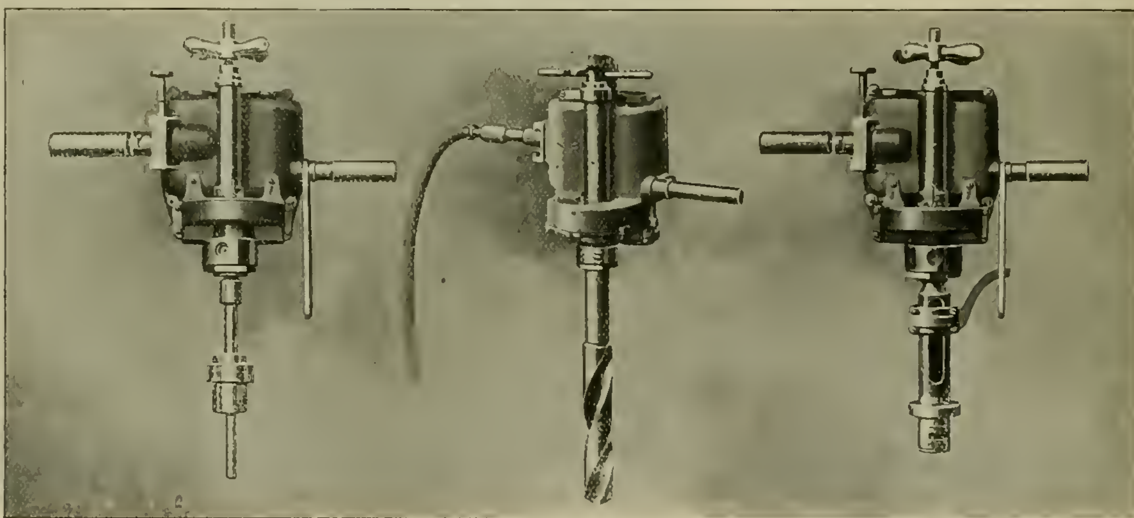
Some Uses of Pneumatic Drills.

The tools shown are Whitelaw reversible drills, made by the Chicago Pneumatic Tool Company, Chicago, Ill. The reversible feature makes them particularly desirable in many classes of work, and this feature seems to be well designed in these tools. They can reverse at full speed, and are under perfect control of the operator.

The No. 8 drill weighs but 30 pounds, yet will drill a 4-inch hole in iron and roll 4-inch flues. These drills have back gears and two speeds, and are very useful in heavy tapping.

The smaller drill, No. 7, weighs but 19 pounds; and while not so powerful as the larger machine, it handles a 2-inch drill easily, in iron.

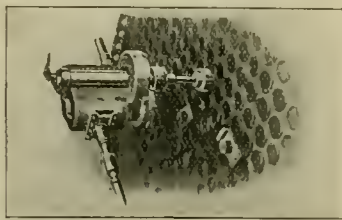
The cost in some railroad shops to cut out old flues and roll in new ones is over 8 cents each. In a test which was made, the No. 7 Whitelaw drill was used with roller, and ten flues were rolled in 2 minutes and 37 seconds, in each case the roller being withdrawn by reversing the motor. After the flues had been rolled, a Boyer hammer, which had been in regular service in the shop for over three years, was brought out, and six of the flues were beaded in two minutes. The machine was then arranged with the cutter attached, and ten flues were cut out in 6 minutes and 5 seconds. The flue roller and cutter feeds automatically by the tapered pin driven by the air motor, and are withdrawn by the reverse motion.



No. 7 with Flue Roller. No. 7 with Drill. No. 7 with Flue Cutter.

WHITELAW REVERSIBLE DRILLS WITH DIFFERENT TOOLS.

A traveling engineer was once examining a fireman for promotion, and he questioned him about what he would do if he had a broken valve yoke. The question was answered correctly about taking up the steam-chest cover and securing the valve to cover the ports, and then the traveling engineer asked, "Now, suppose when you had that work done, and were going to put on the steam-chest cover, you accidentally let it fall and it got broken, what would you do in that case?" "I would disconnect the steam pipe," said the candidate, "and put in a liner." "But suppose you could not get the bolts out; they are very hard to get out, and you had no means of forcing them out, what would you do then?" The fireman cogitated for a minute and then he replied, "I should take mighty good care not to let the steam-chest cover fall."



ROLLING FLUES.

According to the New South Wales *Railway Budget*, Pintsch gas has been installed on the new cars for the Aburry express service. Their use was delayed temporarily by a failure to get the gas plant in operation. They are also to be used on the Bendigo and Ballarat trains. They seem to progress faster than some of our own roads.

The Case Manufacturing Company, Columbus, O., have issued a neat catalog calling attention to the advantages of their three motor electric traveling cranes for railroad shop service. There is also a locomotive crane shown; or, to be more explicit, a crane mounted on a car with boiler, engines, etc., that can move itself over a track to any position. This is a 5-ton crane, with a reach of 15 feet, which weighs, all told, 22 tons. The details seem to be well worked out, and for yard work it is a very useful machine. Handling material is quite a problem at best, and those interested should obtain one of these catalogs.

Mr. George B. Hodges, secretary Educational Department, Young Men's Christian Association of North America, has sent us his annual report, and also prospectus for 1898. We do not need to expatiate to our readers on the good educational work that the Y. M. C. A.'s rooms are doing; but in looking over the report, we have been surprised to see the extent and variety of educational facilities which the association provides for young men. Those who desire further particulars should apply to the International Committee of Young Men's Christian Association, 3 West Twenty-ninth street, New York.

Messrs. Keasbey & Mattison, of Ambler, Pa., have been having some interesting results from recent tests of laggings. These tests are very interesting, and the sheet containing them can be obtained on request from the above address. As boiler and cylinder clothing is an important subject, this is well worth sending for.

The Long Island Railroad Company have sent twenty locomotives to Rogers to be converted into Wootten slack anthracite burners. They will be used on fast suburban service.

Soft Coal Burning.

The above is the title of an illustrated pamphlet by Mr. C. M. Higginson, of the Atchison, Topeka & Santa Fé, recently issued by the *Railway Master Mechanic*, Chicago. The study of combustion has been for years a hobby with Mr. Higginson, and his crusade against the smoking furnace has been the means of convincing many people that the smoke nuisance could easily be abated. The pamphlet is devoted principally to showing and describing mechanical appliances for admitting air above the fire to aid in the combustion of the volatile gases. The author says that the air needed to burn the gases arising from bituminous coal gives the best results when admitted above the fire. This may and may not be correct, as a means of smoke-prevention; but we have never seen a furnace where air was admitted above the fire that did not burn more fuel than the same furnace arranged to draw its entire supply of air through the grates.

Parties interested in smoke-prevention will find in this pamphlet illustrations of all the mechanical appliances of any value that ever have been invented to promote clean combustion of coal and to prevent the emission of smoke. We differ decidedly from Mr. Higginson in the value he puts upon some smoke-preventing appliances; but we thoroughly endorse the sentiment expressed as a whole, and especially in the following paragraph copied from the pamphlet:

"No matter how perfect the device is, a large portion of the ultimate success depends upon the firing, and without care in this direction, anything short of automatic stoking may be rendered useless."

Annealing Steel.

Learned essays have been written on the proper temperature of steel for annealing by water, so as to get that indefinable softness that requires a certain degree of hardness to work well. Everyone who has water-annealed steel, has at some time been close to the desired result, and on repetition found that the same apparent temperature did not produce the same kind of a "soften" in the same steel. The reason for this peculiar behavior may be traced to the different intensity of light under which the several pieces are treated. It is well known to the practical man that when a piece of steel is nearing a dull red, that it is approaching the best temperature to dip.

The success of the annealing process by quenching is therefore dependent on how the color is viewed. A dull red in the daylight is a bright red in a diffused light, and grows brighter, of course, as the darkness is intensified. A very sure way to soften a piece of steel is to have the red barely visible in a subdued light, in which it will have entirely disappeared in ordinary daylight. Steel thus cooled will usually be soft enough to turn well without that "cheesy" work under a tool, that is so disliked if a tap or reamer is in contemplation.

Two Carloads of Torpedo Boats.

A recent visit to the yard of one of the large roads revealed two carloads of interesting relics of the memorable 3d of July on the Cuban coast.

They are young torpedo boats, said to have been captured from the Spanish vessels, and their misshapen appearance indicates that they have seen hard times recently. They are short, perhaps 18 feet long, and had been driven by storage batteries, many of the plates and cases of the batteries lying around on the car.

A convenient camera "made a note" of them, and we reproduce them herewith.

RELICS OF SANTIAGO—SMALL TORPEDO BOATS.

A dreadful accident once happened in the Sormovo Locomotive Works, in Russia, shortly after they were started. A man in charge of an electric machine, contrary to orders, started to clean it while it was running. His arm got caught in the mechanism and was torn off at the shoulder. The man did not call for assistance, but ran without aid to the hospital, leaving his arm in the machine. When asked afterwards why he did such a foolish thing, he shrugged the remaining shoulder and answered, "The will of God."

During the past summer the Joseph Dixon Crucible Company, of Jersey City, N. J., have added an extension to their pencil factory, 40 by 90 feet, three stories high. The same is driven by electric power from generator placed in the main factory. No expense has been spared in the equipment of this addition in the way of up-to-date elevators, furnaces, dry-rooms, etc. The company will also put down an Artesian well, several hundred feet in depth, for a supply of water for factory use, and some time during 1899 various other additions will be built to the Dixon Company's very extensive plant.

There has just been erected in the Mount Clare shops of the Baltimore & Ohio Railroad, at Baltimore, a new high-pressure steam boiler for the purpose of testing locomotive boilers under steam pressure. Heretofore a locomotive had to be hauled to the outside of the shop, fire built in the firebox and steam gotten up, in order to make a test, this method consuming much valuable time. Under the new arrangement all this is done while the engine is standing in the shop, a system of steam pipes having been arranged so that the engines on any track in the erecting shop can be tested without being removed.

"A Modern Roundhouse Turntable" is the name of an illustrated pamphlet recently issued by the Westinghouse Electric Company. It illustrates and describes a device for operating a turntable by a small electric motor. We have seen one of these motors at work, and its operation is satisfactory in every way. The only surprise to us is that it has not been already applied to all turntables that have to turn more than ten locomotives a day. A very good feature about this motor is that no change has to be made on the turntable to apply it.

Grates.

BY F. P. ROESCH.

(Second Paper.)

Having disposed of the ash pan, we will now examine the grates.

While there may be instances of engines that have too much grate area, they are very rare, in fact the contrary appears to be the rule, but even with our limited grate area, a radical change in the steaming and coal burning qualities of an engine can often be made by the use of a grate adapted to the kind of coal furnished. Grates have never received the attention or consideration to which they are justly entitled. In fact many master mechanics think so long as the grates in use will dump the fire quickly when engine arrives at terminals, that is all that is required.

Different coals require different grates, not only in the amount of grate opening, but in the general form, and the most wasteful grate is the grate commonly used.

I refer to the long-fingered grates, all shaking in unison.

In shaking these grates, when using coal that is inclined to clinker, instead of shaking the clinker through it is simply lifted, or if broken at all it is only broken so as to let the half consumed coal pass through, while the clinker hangs to the grate. Many firemen make up their minds at the start to shake the grates as little as possible, as the more often they shake them, the more frequently will the ash pan need clearing, consequently they don't touch the grate lever until they notice that "she is beginning to lag a little in steam."

But by this time the clinker has formed and where a slight jar would have given him the necessary draft at first, a vigorous shaking is now required.

Now, at the first pull, the clinker, if not yet too heavy, is broken, and the half-consumed coal rolling off that part of the clinker stuck to the grate ahead, falls through the opening, the next move throws that part of the coal that did not fall through, under the end of the clinker on the next grate, where it is in good position to drop into the pan at the next shake.

Of course after this the engine steams all right again for a little way as he has made openings for the admission of air where the clinkers are broken and loosing the clinkers off the grates has helped him somewhat, but he soon finds that he cannot go as far as at first without shaking the grates. The shakings become more frequent and violent, until at last he must at the first stop clean the clinkers out of his fire either by shoving them through the dump or fishing them through the door with a hook.

With coal of this description is the most radical change necessary, as we must fashion our grate to prevent as much as possible the formation of clinker, and if it does form to crush it, grind it up as it were, and drop it into the pan, while still retaining the unconsumed coal above.

The grate shown in Figs 1, 2 and 3, connected to shake in opposite directions alternately as shown, would in a great measure give these results. The long fingers being spaced far apart and moving in opposite directions would have a tearing action on the clinker which the short fingers would crush and drop into the pan.

It is with this "clinkery" coal that the most trouble is experienced as the most careful firing cannot always prevent the formation of clinkers, consequently with the air openings through the grates restricted, sufficient air cannot pass into the fire to mix with the carbonaceous gases arising from the burning coal and thus bring out its full calorific value. Thus

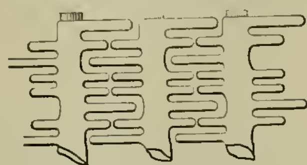


Fig. 1

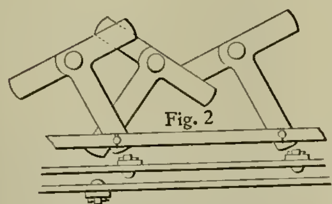


Fig. 2

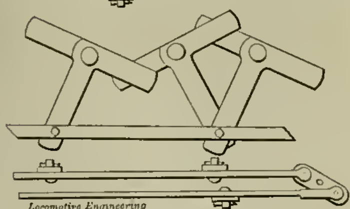


Fig. 3

many pounds of coal are wasted, as the average fireman after he has exhausted (to him) every known method to keep up the pressure, gets disgusted and fires in more coal (although probably aware that the coal already in the firebox is not half consumed). The consequence is another delay report account of no steam. Arriving at the round house and asked as to the cause of his engine not steaming the engineer replies, "She don't cut her fire just right, I think her nozzles are too big!"

So instead of applying the right remedy to the right place, the front end is opened and a bush or split put in the nozzle, with the result that the engine steams better. But she burns more coal.

Passing from "clinkery" coal, we take up mine run or slack, for an order for mine run is generally filled with slack. We would say to those that are desirous of burning cheap coal that the better grade of slack, or what is commonly called nut coal, is generally cheaper than mine run, and if properly handled equally as good. I am speaking now of coal that does not clinker to any great extent. With a sufficient grate area, and a proper form of grate, this coal can be economically burned in most modern engines, and with very good results.

Ask a fireman what is the greatest trouble he experiences, or has to contend with, in burning fine coal, and he will answer, "She burns holes in her fire." Now there must be a cause for this hole burning and it can generally be found in the grate if the ash pan is all right. The grate fingers are too long and the spaces between the fingers are too large. To successfully burn fine coal, the grate fingers should be short (not over 4 inches), and narrow, say 1 inch wide and spaced about ¾ to 1 inch between the intermeshed fingers. These grates should be made to shake in unison.

The dump grate so universally placed next the flue sheet is in many cases another source of annoyance and expense, many cases of leaking flues being traceable directly to its mismanagement. When on the road ashes are often allowed to accumulate on it until they cover the bottom row of flues, which are thereby cooled, and cooling contract and leak, or if it is dropped many firemen often drop with it, half a barrowful or more of unconsumed coal. Of course half a barrowful is not much in itself, but it does not take many to make a ton.

But this is as nothing compared to the damage caused by the fire cleaners at terminals, where the engine is placed over the ash pit, the blower turned on, the dump grate let down, and everything in the firebox is pushed through the dump opening. The cold air drawn in by the action of the blower, rushes through the dump opening and strikes directly on the flue sheet, chilling it more than the rest of the firebox, causing cracks in flue sheet, loose and leaking flues. For this reason we would advocate the abolition of the dump grate where practicable, that is, where the coal consumed does not form into large clinkers, but can be readily shaken through finger grates, but where the dump grate is absolutely necessary in order to facilitate the removal of large clinkers from firebox, we would place it in the back end of the box, so that the inrushing air would be warmed by the heat radiating from the surrounding firebox before it comes in contact with the flues, and the firebox be cooled more equally.

For all long fireboxes 8 feet or more, we believe longitudinal instead of transverse grates would give the better result. First, they would shake easier; second, the fire could be kept level easier, and third, they could be made to rock slightly or dump at will, thus saving time cleaning fires at terminals.

An Odd Coaling Plant.

At the roundhouse of the Northern Central division of the Pennsylvania road in Elmira, they have a coaling scheme for the engines which is not often seen. It's a case of every engine being its own coal hoister, and the plan seems to work well in this case.

COALING—AN OLD COALING PLANT—ONE OF THE CARS.

Fig. 1 shows the hoist with an engine coaling. There is an elevator car inside the uprights, this car being hoisted by a rope passing over a pulley in the top of the structure, down again to a tackle or snatch block, and up the track to another similar block.

When the engine comes down (in either direction, as there are two points for hooking on), the fireman hooks the rope into the drawbar and the engineer runs it down slowly.

The elevator rises, carrying the coal car with it, and when the tank is in position the car is at the right hight to fill it. The picture shows the coal pouring in from the car, the fireman controlling the flow by a rope connection to the side door of the car.

The other view shows the elevator and car at close range, the cars being kept loaded on a track behind the elevator, and gives a good idea of the construction of the car and its truck.

It is a simple device, and seems to perform its work satisfactorily in this case

The Gilman Emergency Knuckle.

The need of a safe and practical device for taking the place of a broken or lost knuckle has brought out the scheme shown in our engraving, in which a shank forming a part of the knuckle, extends into the body of the coupler and holds the knuckle rigidly in the coupled or locked position; it being understood that the coupling of two cars in which one has the emergency knuckle, is made by the unimpaired coupling on the next car, and thus enables a train to be brought into a terminal. Fig. 1 shows this knuckle when in position, and having the standard knuckle contour.

In cases that may chance to occur where this knuckle cannot be applied to a coupler so as to work, that shown in Fig. 2 has been devised with a knuckle whose functions are simply that of a buffer to save the coupler from injury until a repair point can be reached; the idea involved in their use being that one or the other of these will, if carried in the caboose, bridge over any case of break-in-two, and at less cost than with the regulation knuckle.

The inventor, General Foreman Gilman, of the Northern Pacific car department at Tacoma, is enthusiastic over the saving in sight by a reduction of the number of extra knuckles as now carried to provide for emergencies on the road, and also in the lessening of trains parting by reason of the link and pin stretching the air hose to rupture, besides the salvage of the coupler body after the knuckle is broken. Mr. Gilman writes that he has tested every make of coupler passing through Tacoma yard in the twelve months past, and has not found one having a knuckle pin hole to which this emergency knuckle will not apply, out of thirty-nine different builds of couplers. The superintendent of his division has asked to have every engine and caboose equipped with them, an order for which has been placed.

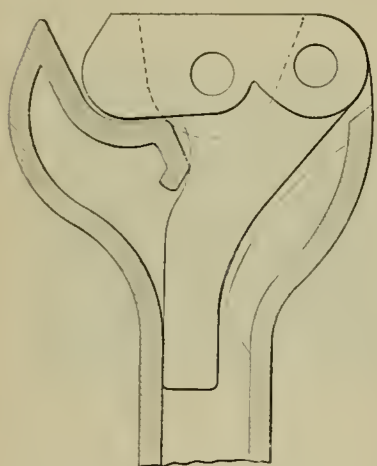


Fig. 1

Fig. 2

EMERGENCY KNUCKLE.

The Boston & Albany have been sprinkling their roadbed with oil for the purpose of laying the dust, which works all right, and the roadbed at all times presents a thoroughly neat and well-kept appearance. But the question has another side, and that is, the odor, which is almost unbearable, and it would seem, in a measure, must be injurious to one's health.

The C. W. Hunt Company, of New York, have recently issued three very handsome illustrated catalogs. One refers to Manila rope, one to apparatus for handling coal and similar material, while the third treats of industrial railways. We find in that devoted to industrial railways a great variety of cars of very narrow gage, which are employed in mines, steel-making establishments, foundries, railroad shops, and, in fact, in every sort of a place where material can be moved more cheaply in a car than by hand. Those interested in the matters treated can obtain the catalogs on application.

During the past month we received a pleasant call from Mr. Burr, president of the Burr Manufacturing Company, that makes the rope hoist. We were gratified to learn that the demand for the hoist is becoming quite active, and it is very popular wherever it has been used.

The most suitable Christmas present for a railroad man is a copy of "The World's Rail Way."

Corrugated Tube Furnaces.

The Fox corrugated furnaces, used in the balanced compound locomotive belonging to the Strong Locomotive Company, are so much out of common practice that railroad men, as a rule, do not care to investigate the merits of the furnace. In these days when there is so much agitation to get more heat out of the coal burned, it seems to us that the Fox furnace is worthy of trial. During a series of carefully conducted tests made at Purdue University, it was found that the boiler showed remarkable economy as compared to other locomotive boilers, especially when hard forced. Speaking about the tests made of this boiler, Professor Goss said:

"The efficiency of a boiler of the ordinary form having the same extent of heating surface, when forced to burn 3,000 pounds of coal an hour, is only about 60 per cent. of that which it gives when 600 pounds of coal are fired per hour; whereas the Strong boiler gave 90 per cent. of its maximum efficiency when being fired at a rate of 3,000 pounds per hour. This increased efficiency under high rates of combustion is attributed to the use of corrugated furnaces, and to the fact that these furnaces were fired alternately, the gases thrown off by the green coal on one side mingling in the combustion chamber with the more highly heated gases from the furnace on the other side. The arrangement of the furnaces also provides a large grate area, which probably, in this case at least, was favorable to economy."

A boiler that behaves so well as that when being forced, deserves to attract more attention than this one has received. As "being forced" is the chronic condition of many locomotive boilers all the time the engines are in front of trains, one which displays 30 per cent. more economy than the common herd is capable of effecting fuel savings that would amount to a big sum at the end of the year.

It is probable that the corrugated furnace may possess inherent weaknesses which would prevent its being profitably used for locomotive boilers. That does not, however, seem to have been demonstrated, and we commend the subject to the attention of the master mechanics of this and other countries.

White-washing Nozzle.

Mr. Conolly, superintendent of motive power of the Duluth, South Shore & Atlantic, has perfected a form of nozzle that makes pneumatic white-washing and painting a success and a joy to all concerned. Fig. 1 is a drawing of the nozzle used. They turn out ten freight cars per day, painted two coats, at a labor cost of 30 cents per car, outside of stenciling. The reservoir has a capacity of 10 gallons of paint, or enough for five cars, one coat.

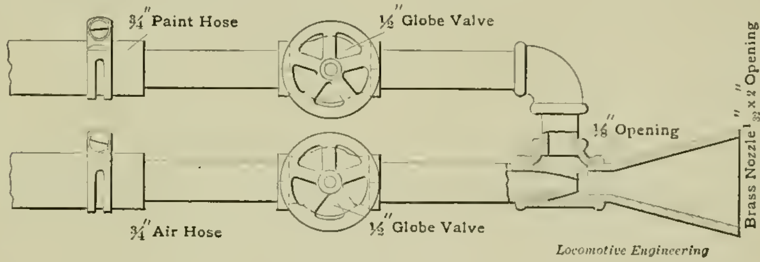


Fig. 1
PNEUMATIC PAINT SPRAYER.

Civil Engineer on the Metric System.

Having had more than twenty years' practical experience in the use (often conjointly) of the English and metric systems, I may be permitted to express an opinion on the subject, if you will afford the space.

What seems to me to govern the utilitarian capabilities and limit the practical application of a system of metrology, be its origin natural or scientific, is the possession of the greatest possible number of easily comparable working-units for all purposes.

Taken in this sense, the metric system can supply quite a redundant variety of units, and it is possible to choose from amongst them an arbitrary unit conveniently applicable to any particular purpose of measurement.

It has the advantage that a unit so chosen is some decimal, centesimal, millesimal, etc., multiple or sub-multiple, power or root, of every other unit of each different class of measures of the system, be the chosen unit myriameter or decimillimeter and their squares and cubes; hectare, kilogram, liter, centigrade, or any other metric measure of are, length, space, weight, energy, etc., together with their respective doubles and halves.

The main point required is, that such unit possess a specific name, and an easily convertible definite value attached to that name.

In its large number of working-units, therefore, and in their decimal relation lies the secret of the success and almost world-wide recognition of the metric system, as being capable of providing a universal measure for each requirement; and whilst legally permissive in English-speaking countries, it can only be on account of the immense loss of capital and the prolonged subsequent inconveniences involved in an abrupt change from one system to another, that it has not been made compulsory.

"The existing hodge-podge," someone has said, "of weights and measures conveys no information to the mind of anyone not educated to it, and for foreign trade, metric measures must be expressed or much of the trade will go to countries using the meter."

The convenience of the metric system is merely a matter of habit or training, whilst just as useful a foot for machine-shop use can be and is made of the Swiss decimal-foot, 300 millimeters in length, as of one-third of a yard, or the 10, 11, 12, 13, 14 or 15-inch length of any other of the heterogeneous agglomeration of feet, fuss, pied, or pé; a duodecimal relation to the 300 millimeters being fairly satisfactorily scalable, convertible and expressible in its millimetric terms.

I agree that the metric system in its practical working has no more claim to be called "scientific" than any other decimal system similarly applied (as, for example, the Japanese, in which the primary unit is the English decimal foot), grant but a specific name to each decimal multiple and sub-multiple of the basic unit.

All metrological systems seem to be affected with basic defects due to the scientific determination of their values, but this does not trouble the practical working. It was found impossible to carry out with scientific precision the metric system as originally proposed and as it was defined, and in practice no system is free from similar defects.

For instance, we all know that a spring which will counterbalance a true kilogramme or other weight at the Palais des Archives of Paris, will not exactly counterbalance the same kilogramme or weight at another place; and that a litre of water at a given temperature, pressure, altitude and latitude, is not a litre at any other. Similarly, the length of the basic mètre itself is affected by changes of temperature. Still, their usefulness as weights and measures is not impaired so long as their correct values, to a small fraction, can be determined; and French and English continue to scatter about the globe their liters and feet, without humanity, in the slightest degree, suffering inconvenience from the altered capacity of their corn, liquor and other measures.

Some interesting statistics might be made showing the profit and loss due to this cause.

The fact of the matter appears to be, that for most purposes in life nobody cares the proverbial two straws, or to an inch, etc., or two, what the scientifically defined or determined length, weight or capacity of the basic units may be, so long as the measures in use are easily comprehended and comparably correct, within reasonable limits, to a known standard. The State specifies what those limits are.

Even the mètres are not uniform. Many of the meter measures exported from France, Germany and other countries are very unequal in length, and I have compared dozens of meters that could not have been mètres by several millimeters; also some micrometer gages that differed from each other by hundredths of a millimeter, or by thousandths of an inch.

For the above reasons, and to avoid mistakes, all important machinery is, of course, made to special gages, the different parts of machines being carefully calipered, or directly accurately fitted to each other by trial, without further reference to original standards, scale dimensions or to primary units of measure.

I once had an ivory foot-scale by a New York maker, that was seven sixty-fourths of an inch too long, and for years I remained under the impression that the American foot was just so much longer than the English. It came in handy, however, for the increase of dimensions for patterns for castings, until one day my chief got hold of it, and, ignorant of its exemplary merits, made use of it for another purpose. He got into a muss, smashed it up, and pitched it away.

Now we are on the subject of drafting scales. Why, the metric system has a complete decimal series ranging somewhere between minus — and plus infinity to one; and it is wonderful to see the facility and rapidity with which a smart draftsman, trained to the system, can plot any measure directly from the simple millimeter divisions, when he hasn't the special scales handy. He is from childhood trained to meters, thinks in meters, does everything by meter; and whether his meter be, in comparison with a standard, a long or a short one, it makes no difference in the principle of measuring with or plotting from it.

If, at the time of the promulgation of the metric system, it had been well known that ordinary work-a-day measures could never be what their basic prototypes are scientifically defined to be, there appears to be no reason why the decimalized yard or foot might, could, would or should not, with equal propriety as any imaginary or a platinum standard mètre, have been proclaimed the manufacturing and commercial utilitarian world's "scientific" primary unit of measure, had it only been thought of.

But it wasn't; and consequently the yard will probably take a back shelf in the course of time, unless it ordains to set up for itself in a duplex system as 900-1000ths of an opposition natural 40-inch meter (it is 915-1000ths of the French one), and then the 300 milli-40-inch-meter foot may yet reign supreme in its 12-thumbed, 10-deci-foot, 4-fingered, 3-handed, sesqui-spanned, two-, four- and six-footed usefulness; the centipedal arrangement being 30 of the proposed statute-meters, and this

New Ideas.

New ideas, no matter how great their value may be to future generations, are plants of very slow and uncertain growth. In fact, if it were not for a few enthusiastic believers and workers, many of the best ideas would abort like early peach buds.

Nearly forty years ago, Rankine wrote that, "In furnaces where the draft is produced by means of a blast pipe like those of locomotive engines, or by means of a fan, the quantity of air required for dilution, although it has not yet been exactly ascertained is certainly much less than that which is required in furnaces with chimney draft; and there is reason to believe that on an average it may be estimated at about one-half of the air required for combustion." Such has since proved to be the fact, and at the present day the subject of mechanical draft engages the attention of every progressive engineer in the designing of a steam generating plant.

In fact it is now understood that mechanical draft is accepted as a convenient and efficient substitute for the chimney under all ordinary conditions.

It may be said that the economical necessities were not so imperative forty years ago when Rankine and Clark pointed out its marked advantages and the future was but dimly discerned when only fifteen years ago Seaton referred to the chimney as the rough and ready but exceedingly wasteful way of inducing the air to flow into furnaces with sufficient velocity to cause the fuel to burn, and prophesied that it would some day be superseded by more scientific and economical apparatus.

In a similar way and after most exhaustive tests, Professor R. H. Thurston demonstrated over twenty-five years ago that pure flake graphite, mixed with enough water to distribute it over the bearings, under the same number of pounds pressure and traveling at the same rate of speed, did nearly three times more work than the best quality of winter sperm oil, which was at that time considered the standard lubricant. He further demonstrated that when 15 per cent. by weight of Dixon's pure flake graphite was added to the best quality of lubricating grease the bearings could be run nearly six times longer, at the same high rate of speed, than when the same kind of grease was used without the graphite. Furthermore, where the graphite was used there was no cutting and the bearings were in perfect condition.

About five years ago, Professor Albert Kingsbury of Durham, N. H., while making some tests on the friction of screws, found a great lessening of friction by means of graphite, as will be seen by the following, taken from his notes:

Lubricant.	Min. Friction.	Max. Friction.	Mean Friction.
Lard oil.......... Heavy machinery.	.09	.25	.11
Oil (mineral)..... Heavy machinery.	.11	.19	.14
Oil and graphite.. Equal volumes.	.03	.15	.07

It may be safely prophesied that while graphite will probably not entirely supersede the use of oil any more than mechanical draft will entirely take the place of the chimneys which now dot our land, it will nevertheless be used in the future far more extensively than it has in the past, and thereby greatly reduce the cost of lubrication and insure better running engines and machinery and a minimum cost for repairs.

The Joseph Dixon Crucible Company, Jersey City, N. J., are headquarters for graphite of all kinds and for all purposes, and are always glad to send samples of their products to anyone interested.

meter 3⅓ feet or 1 1-9 yard. There would then surely be enough easily convertible, well-known units to choose from.

I dare to suggest that such a duplex system (decimal and ternary) with a new meter equivalent to ten-ninths of the yard, would more than satisfy all requirements, and perhaps involve less financial loss and inconvenience to the world to conform to it, and alter all the existing German, French and other "scientific" and barbarian measures in existence, in all countries (in some of which the old names and quantities are sacredly adhered to and survive in spite of the mètre, goods being doled out or bought in their nearest metric round-number values), than it would to abruptly abolish, at the present moment, the foot, yard and inch. If these be retained as aliquot parts in a ternary-metric system, all the other weights and measures might, in time, be wiped out of existence.

The economic question is: How much would there be to pay? What would be the relative cost of the immediate adoption of either the 39⅜ + inch or the 40-inch meter?

R. J. CALLANDAR.

Ceara, Brazil.

A Car Replacer.

A device to assist in the replacing of a derailed locomotive or car is one of those things that is badly needed when occasion for its use arises. The ruling idea in appliances of this character, that of an inclined plane, seems to cover most of the requirements when time is not to be considered.

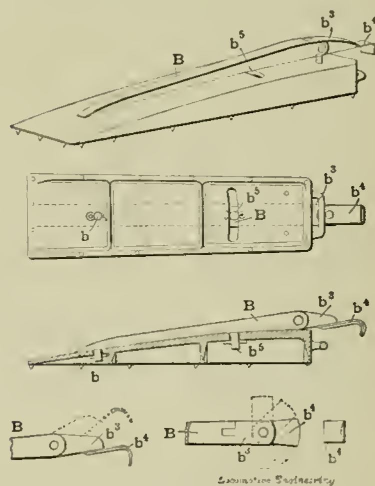
With the belief that a car replacer would be more efficient if it had some adjusting feature about it, Mr. Geo. A. Bull, roundhouse foreman of the Erie at Marion, Ohio, devised that shown in our engraving. The base is of malleable iron, cored for lightness and ribbed for strength, with the underside having projecting points to engage with ties, so as to avoid any tendency to slip.

The guide *B* on top of the casting is a steel bar pivoted at *b*, near the point of the wedge, and has a radial movement which is governed by the length of the slot near the base of the wedge, into which works a pin b^5 from guide *B*. The advantage of an adjustment here lies in the fact that the guide can be made operative at an angle with the wedge. There is also an adjustable end b^3, which is secured to the guide *B* by a tongue and jaw, and has a vertical movement. To this part b^3 is pivoted the rail clamp b^4, so as to have a horizontal motion. These are the principal points that make the replacer a good thing to tackle a derailment with. The handle cast on the base of the wedge shows attention to the portable phase of the problem.

The Dutch Clock.

Events in railroad history move along so rapidly that appliances largely employed at one period will be almost forgotten within a decade. Fifteen years ago one of the greatest annoyances that train men suffered from was the use of the "Dutch clock," yet many train men to-day scarcely know the meaning of the expression. The Dutch clock, as it was universally called among railway men, was a speed recorder which was placed in the caboose of freight trains and made lines on a roll of paper that indicated the speed of trains and the duration of stops. It was invented by a minister in Canton, Ohio, and was taken hold of by exceedingly energetic agents, who pushed it upon nearly every railroad manager in the country.

The railroad tracks at that time were nearly all inferior, fast running was dangerous, and wrecks common. The order to engineers not to exceed a speed of fifteen miles an hour between stations was



NEW CAR REPLACER.

almost universal. Those who issued the order often did so to escape blame in case of accident; but others were sincere in their efforts to prevent running above the schedule speed. Those who were opposed to fast running saw in the Dutch clock a means of detecting violations of the rules relating to train speeds, and they lost no time in putting it upon their way cars. Others followed suit because it was the fashion, and soon the greater part of the railways in the Middle and Western States were provided with speed recorders.

American ingenuity was equal to the task of vitiating the records made by the speed recorder. It was operated by clockwork, and various plans were adopted by train men to prevent it from showing speed that was in excess of the regulations. One scheme was to slip a piece of oil paper under the marker and then it recorded an unintelligible blotch. That trick was soon found out. Then some one discovered that if you wind up a clock tight and hold pressure on, it proceeds to run fast. They utilized this knowledge to make the clock record the stereotyped fifteen miles when the train was running at much greater speed. Sitting beside the recorder holding up the winding mechanism was a tiresome business, and some genius about Kansas City invented what was known as "The Mother-in-Law." This was an apparatus that was attached to the winding key and kept up extra tension as long as it was in use. Train men occasionally found themselves in an embarrassing position when they made a fast run and discovered that the mother-in-law had dropped off.

Various other resorts were adopted for preventing the Dutch clock from telling upon the violators of rules, and it is doubtful if the apparatus did much to fulfill the duties for which it was applied. Railroad managers soon began to realize that where the train men respected the speed recorder, the movement of trains was materially retarded. An anecdote is told of John Gault, a famous railroad manager, who was solicited to purchase speed recorders. "What good will it do?" demanded that highly practical railroad man. "Will it make our trains run faster? Will it help a locomotive to pull more cars up a grade?"

"Well, no," replied the agent, "it will prevent trainmen from running too fast."

"That won't suit me," said Gault. "The trains run too slow now. What I am looking for is something that will help relieve the block of freight cars the road is suffering from. Train men are the best judges of how fast a train can be run safely. The train sheet is a good enough speed recorder for me."

From a statement issued by the Safety Car Heating & Lighting Company, we learn that this light has been applied to 85,600 cars and 3,164 locomotives. Most of the locomotives using Pintsch gas are in Germany. There are no locomotives in America using Pintsch gas, which is rather surprising considering the convenience of this method of lighting for headlights and cabs.

The gold medal at the Trans-Mississippi & International Exhibition, held at Omaha, has been awarded against all competitors to the Cleveland Twist Drill Company.

The Proceedings of the Traveling Engineers' Association for 1898 is out, and makes good and valuable reading for people interested in the care, handling and maintenance of the locomotive. It is for sale in this office: price 75 cents for paper-bound, $1 for leather bound.

Baxter D. Whitney, Winchendon, Mass., has just issued a new catalog of his well-known wood-working machinery, which is pretty sure to attract attention. An embossed cover and numerous half-tones make a very attractive catalog, and it shows a line of tools that will interest the car department of any railroad.

"Buckeye Specialties" is the name of an illustrated catalog recently issued by Macleod & Clark, of Cincinnati, O., showing the specialties handled by the firm. The principal of these is the Buckeye light, which is a very brilliant affair, and is provided for the use of contractors and others who have to do outdoor work at night. Those who have used this light speak very highly about it. Besides the light, there are gas rivet heaters and forges, paint spraying apparatus and a variety of different kinds of pumps. The catalog will be sent free on application.

We are constantly receiving applications from enginemen for recipes for polishing metal. Those who want something that will shine up their brass with the least possible exertion should send for a box of the U. S. Metal Polish Paste, which can be obtained from Geo. W. Hoffman, 295 East Washington street, Indianapolis, Ind.

Messrs. Robert W. Hunt & Co., the well-known testing and consulting experts, have moved their New York offices from 80 Broadway to the new Empire Building, 71 Broadway. This is one of the finest buildings in New York and affords them better facilities than before, at the same time being near enough to their old office to be easily and quickly found.

Attractive grounds around stations, especially in small places, add much to the enjoyment of travelers, particularly on local trains. We are glad to note that more attention is being paid to this than formerly by many of the roads. A recent trip over the Lehigh Valley showed considerable artistic gardening along its route.

One of our subscribers writes us that he has for sale back numbers of LOCOMOTIVE ENGINEERING, from April, 1893.

One of the most gigantic railroad enterprises that is coming gradually to the front is the extending of a railway from Cape Town, Africa, to the navigable part of the Nile. The enterprise is backed by the British government, and the Hon. Jos. Chamberlain, Secretary of State for the colonies, has made the statement that the enterprise would be realized within another decade.